

DIVISION 8 MISCELLANEOUS CONSTRUCTION**SECTION 8-01 EROSION CONTROL****8-01.1 DESCRIPTION**

Section 8-01 describes work consisting of preparing slopes, placing and compacting topsoil, seeding, fertilizing, placing matting or clear plastic fabric or erosion control fabric, placing matting or erosion control fabric with mulching, and mulching all graded and disturbed areas as specified in the Contract.

8-01.2 MATERIALS

Materials shall meet the requirements of the following Sections:

<i>Landscape Materials</i>	<i>9-14</i>
<i>Water For Irrigation</i>	<i>9-25.2</i>
<i>Silt Fence Materials</i>	<i>9-05.22</i>

8-01.3 CONSTRUCTION REQUIREMENTS**8-01.3(1) PREPARATION OF AREA****8-01.3(1)A CULTIVATION**

Areas to be cultivated shall be at locations indicated *in the Contract*, shall be cultivated to a minimum depth of 4 inches, and shall provide a reasonably firm but friable seed bed. Cultivation shall not take place if the soil is excessively wet. Seeding shall take place within 2 weeks of cultivation. When topsoil, lime, decomposed *organic mulch amendment*, or other amendments are required, they shall be incorporated into the subgrade by rototilling to a depth of 4 inches or deeper as required to provide the desired homogenous mixture.

Cultivation of the soil may be by rototilling, farm disc, harrow, or other suitable Equipment acceptable to the Engineer. Cultivation shall be done at right angles to the natural flow of water on the slope.

Prior to the cultivation, the Contractor shall remove all visible rocks, clods and debris larger than 1-1/2 inches.

Exposed tree roots in cut slopes shall be clean cut at the finished grade of the slope. Cultivation within the dripline of existing trees to be retained shall be reduced in depth to minimize adverse impact to the tree's roots (see Section 1-07.16(2)).

8-01.3(1)B COMPACTION

In addition to the compaction that may be required elsewhere in the Specifications, all areas to be seeded, including excavation slopes, shall be compacted and prepared as shown in the Standard Plans in accordance with the Standard Specifications. Unless seed is covered with soil during seed application, a cleated roller, crawler tractor, or similar Equipment acceptable to the Engineer, that forms longitudinal depressions at least 2 inches deep shall be used for compaction and preparation of the surface to be seeded. The entire area shall be uniformly covered with longitudinal depressions formed perpendicular to the natural flow of water on the slope *unless otherwise indicated in the Contract*. The soil shall be conditioned with sufficient water so the longitudinal depressions remain in the soil surface until completion of the seeding. The area shall be compacted within three weeks of the time of seeding. Prior to seeding, the finished grade of the soil shall be 1 inch below the top of all curbs, catch basins, walks, driveways, and other Structures. Compaction by backblading or rolling is permissible for small applications provided that follow-up machine or hand-raking loosens the top 1 inch of soil.

8-01.3(1)C PREPARATION

All areas to be seeded shall meet the specified finish grades and shall be free of undesirable weed or plant growth and all clods, rocks, and debris 1-1/2 inches or larger in any dimension.

When soil fill is required to meet finish grades in areas to be maintained as lawn, fill shall be Playfield Soil.

8-01.3(2) TOPSOIL AND PLAYFIELD SOIL**8-01.3(2)A GENERAL**

Topsoil, playfield soil, decomposed organic mulch amendment or fertile mulch shall be evenly spread over the specified areas to a minimum depth of 1.5 inches, unless otherwise shown in the Contract, and shall be cultivated as specified in Section 8-01.3(1)A. After the topsoil has been cultivated, all large clods, hard lumps, rocks 1 inch in diameter and larger, and litter shall be raked up, removed, and disposed of by the Contractor.

Topsoil shall not be placed when the ground or topsoil is frozen, excessively wet or, in the opinion of the Engineer, in a condition detrimental to the Work.

8-01.3(2)B TOPSOIL TYPE A

Topsoil Type A shall be obtained from a source provided by the Contractor outside the Right of Way.

8-01.3(2)C TOPSOIL TYPE B

Topsoil Type B shall be native topsoil taken from within the Project Site complying with Section 9-14.1(2).

Topsoil Type B shall be taken from areas indicated in the Contract to the designated depth and placed at locations which do not interfere with the Work. Areas beyond the slope stakes shall not be disturbed.

When topsoil Type B is specified in the Contract, it shall be the Contractor's responsibility to perform the excavation operations in such a manner that sufficient Material is set aside to satisfy the needs of the Project.

Upon completion of the Work, topsoil Type B remaining and not required for use on the Project shall be disposed of.

Should a shortage of topsoil Type B occur and the Contractor has wasted topsoil Material, the Contractor shall furnish topsoil Type A at no expense to the Owner.

Topsoil Type B will not be considered as selected Material as defined in Section 2-03.3(10), and the conditions of Section 2-03.3(10) will not apply.

Material taken from roadway excavation, borrow, strippings, or other excavation items and utilized for topsoil will not be deducted from the pay quantities for the respective items.

8-01.3(2)D PLAYFIELD SOIL

Playfield soil shall meet the requirements of Section 9-14.1(4)B, and shall be installed as indicated *in the Contract*.

8-01.3(3) DECOMPOSED ORGANIC MULCH AMENDMENT AND FERTILE MULCH

Decomposed *organic mulch amendment* shall meet the requirements of Section 9-14.4(5). Fertile mulch shall meet the requirements of Section 9-14.4(4). The type mulch will be specified on, and shall be installed, as indicated *in the Contract*.

8-01.3(4) SEEDING AND FERTILIZING

8-01.3(4)A SEEDING

The Contractor shall notify the Engineer not less than 24 hours in advance of any seeding operation and shall not begin the Work until areas prepared or designated for seeding have been approved. Following the Engineer's approval, seeding of the approved slopes shall begin immediately.

Seeding shall not be done during windy weather or when the ground is frozen, excessively wet, or otherwise untillable. Unless otherwise specified in the Contract, seed shall be applied at the respective rate for the specified seed mix per Section 9-14.2. Seed shall be sown by one of the following methods:

1. **An approved hydro-seeder which utilizes water as the carrying agent and maintains continuous agitation through paddle blades. It shall have an operating capacity sufficient to agitate, suspend, and mix into a homogeneous slurry the specified amount of seed and water or other Material. Distribution and discharge lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic discharge spray nozzles which provide a uniform distribution of the slurry.**
2. Approved hand seeders for small area applications.

Areas in which the above methods are impractical may be seeded by approved hand methods.

Seed and fertilizer may be applied in one application provided that the fertilizer is placed in the hydroseeder tank no more than 30 minutes prior to application. The seed shall have a tracer added to visibly aid uniform application. This tracer shall not be harmful to plant and animal life. If wood cellulose fiber mulch is used as a tracer, the application rate shall not exceed 250 pounds per acre.

8-01.3(4)B FERTILIZING

Unless otherwise specified in the Contract, fertilizer shall be applied in accordance with the requirements for seeding in Section 8-01.3(4)A, and applied as specified in Section 9-14.3(1) with regard to formulation and rate of application.

8-01.3(4)C LIMING

Agricultural lime shall be applied to all areas cultivated as described in Section 8-01.3(1)A at a rate of 100 pounds per 1000 square feet unless otherwise indicated in the Contract.

8-01.3(5) MULCHING

Wood cellulose fiber mulch, as specified in Section 9-14.4(2), shall be included in the hydroseeding process. The application of seed, fertilizer and mulch shall be required in a single operation for all seed applications, *unless otherwise directed in the Contract*. The application of mulch only, as a temporary stabilization method, shall conform to the application requirements specified in Section 8-01.3(4)A. Other mulch Materials, *if specified in the Contract*, shall be furnished, hauled, and evenly applied at the rates indicated, and shall be spread on seeded areas immediately after seeding.

Distribution of straw mulch Material shall be by an approved type mulch spreader that utilizes forced air to blow mulch Material on seeded areas. In spreading straw mulch, the spreader shall not cut or break the straw into short stalks.

Areas not accessible by mulching Equipment shall be mulched by approved hand methods.

Mulch sprayed on signs or sign Structures shall be removed the same Day.

8-01.3(6) SOIL BINDER OR TACKING AGENT

Unless specified otherwise in the Contract, wood cellulose fiber mulch (per Section 9-14.4(2)) shall have tackifier incorporated into the mulch fiber during manufacture. If additional tackifier is *required by the Contract*, the tackifier shall be as specified in Section 9-14.4(8). When specified, soil binders and tacking agents shall be applied in accordance with the manufacturer's recommendations.

8-01.3(7) DATES FOR APPLICATION OF SEED, FERTILIZER, AND MULCH

Seeding, fertilizing, and mulching of slopes shall be performed during the following time frames:

1. West of the Cascade Range summit April 1 to May 31, and September 1 to October 31.

2. *Written permission to seed from June 1 to August 31, and from October 16 to March 31 will only be given when completion of the Project is imminent and the environmental conditions are conducive to acceptable growth. Application of pre-germinated seed, moisture retention agents and/or provision for supplemental watering may be required by the Engineer should the Contractor schedule this portion of the Work outside the time frames listed in item 1 immediately above.*

All Roadway excavation and embankment slopes, including excavation and embankment slopes that are partially completed to grade, shall be prepared and seeded during the first available planting period and shall not be allowed to sit idle for long periods of time without receiving the erosion control specified in the Contract.

When environmental conditions are not conducive to *acceptable* results from seeding operations, the Engineer may order the Work suspended, and it shall be resumed only when the desired results are likely to be obtained.

8-01.3(8) PLACING MATTING, CLEAR PLASTIC COVERING, AND TEMPORARY SILT FENCE

8-01.3(8)A PLACING MATTING

Immediately following the establishment of the finished grade, excelsior or jute matting shall be unrolled parallel to the flow of water *at locations indicated in the Contract*. Seed and fertilizer shall be placed prior to the placing of matting. Where more than one strip of matting is required to cover the given area, it shall overlap the adjacent mat a minimum of 6 inches. The up-slope matting shall overlap the edge of the downslope matting by 6 inches. The up-slope end of each strip of matting shall be staked and buried in a 6-inch deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (one stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench. *The Engineer may require that any other edge exposed to strong flow of water or prevailing winds be staked and buried in a similar manner.*

Matting edges shall be buried around the edges of catch basins and other Structures. Matting *shall* be spread evenly and smoothly and in contact with the soil at all points.

The matting shall be held in place by approved wire staples, pins, spikes or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart, with a minimum of three rows for each strip of matting, with one row along each edge and one row Alternately spaced in the middle. All ends of the matting and check slots, if required, shall be fastened at 6-inch intervals across their width. Length of fastening devices shall be sufficient to securely anchor matting against the soil. Anchors shall be driven flush with the finished grade.

8-01.3(8)B PLACING CLEAR PLASTIC MATTING

Clear plastic covering (see Section 9-14.5(3)) shall be installed on erodable slopes where indicated in the Contract.

The clear plastic covering shall be installed immediately after completion of the application of roadside seeding and shall be in place before the fall rainfall begins.

The Contractor shall maintain the cover tightly in place by using sandbags or tires on ropes with a minimum 10-foot grid spacing in all directions. All seams shall be taped or weighted down full length. There shall be at least a 12-inch overlap of all seams. The Contractor shall be responsible for prompt repair of all damaged areas.

8-01.3(8)C TEMPORARY SILT FENCE

Temporary silt fence shall be constructed in accordance with Section 2-12.3(6).

8-01.3(9) PROTECTION AND CARE OF SEEDED AREAS

The Contractor shall performing the Work in accordance with Section 1-07 and with the following requirements:

1. *Protect seeded areas from Traffic by use of approved warning signs and barricades.*
2. *Areas which have been damaged through any cause prior to acceptance, and areas failing to receive a uniform application at the specified rate, shall be regraded, reseeded, refertilized, and remulched.*

8-01.3(10) INSPECTION

Inspection of any treated area will be made when seeding, fertilizing, and mulching are completed. Areas not receiving a uniform application of seed, fertilizer, or mulch at the specified rate shall be reseeded, refertilized, or remulched.

Acceptance of areas receiving seed, fertilizer and mulch, as required, shall be based on a uniform stand of grass. Areas failing to show a uniform stand of grass 90 Days after seeding application shall be reseeded. Reseeded areas will be subject to additional inspection for acceptance 30 Days after reseeded. Uniform stand of grass shall be defined as any grass area with no bare spots greater than 6 square inches.

8-01.3(11) MOWING

When the Bid Form contains the Bid item "Mowing" or when mowing is required, the Contractor shall mow all grass growing areas and slopes 2-1/2 horizontal to 1 vertical or flatter except for naturally wooded and undergrowth areas. Trimming around Traffic facilities, Structures, curbs, tree pits, planting areas, or other features extending above ground shall be accomplished by use of power-driven or hand-operated machinery and tools to achieve a neat and uniform appearance.

Each mowing shall be considered as one coverage of all grass areas to be mowed within a defined area. Prospective Bidders shall verify the estimated acreage for mowing as shown in the Contract, the topography, irregularity of the area, slopes involved, and access limitations to determine the appropriate Equipment to use. Equipment and tools shall be provided such as, but not limited to, tractor-operated rotary or flail type grass cutting machines and tools or other approved Equipment. Power driven Equipment shall not cause ruts or deformation of improved areas. Sickie type grass cutters will be permitted only on slopes of drainage ditches, berms, or other rough areas. The Equipment and tools shall be in good repair at

all times and maintained so that a clean, sharp cut of the grass results. *The actual number of mowings will be based on the growth rate of the grass where mowing is required at a height of grass of 3 to 4 inches, producing 1-1/2 to 2 inch blade height.*

Grass cutting machinery shall be operated in such a manner and equipped with suitable guards as to avoid throwing rocks or debris onto the Traveled Way or off the Right of Way. Equipment which pulls or rips the grass or damages the turf in any manner will not be permitted. *The Engineer will be the sole judge of the adequacy of the Equipment and methods of use.* The Contractor may request permission to mulch clippings in place based upon the Engineers pre-approval of Equipment, mowing height and proposed mowing schedule. The Contractor shall collect or remove clippings from the Project except on the Traveled Way, Shoulder, walkway, or other improved areas.

8-01.3(12) SHEAR BOARDS

Where shear boards are required they shall be furnished and installed by the Contractor in accordance with the details shown in the Contract. The top edge of the installed boards shall project 2 inches above the ground.

The shear board shall be spaced at intervals indicated in the Contract and securely nailed to 2-inch x 4-inch stakes (min 4 per board). Stakes shall have a minimum penetration into the soil of 2 feet.

8-01.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement of erosion control by seeding, hydro-seeding or mulching together with required additives including but not limited to fertilizer, soil binder or tacking agents will be by the square foot of surface area treatment accepted.

Measurement of matting, including clear plastic covering, will be by the square foot measurement of surface area covered and accepted. Measurement will not be made for overlapping or folds.

Measurement of shear boards will be by the linear foot of shear board installed and accepted.

8-01.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-01 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Erosion Control, Seeding"**, per square foot.

The Bid item price for "Erosion Control, Seeding" shall include all costs for the work required to prepare the area for seeding, and to seed and protect the seeded areas.

2. **"Erosion Control, Hydro-Seeding"**, per square foot.

The Bid item price for "Erosion Control, Hydro-Seeding" shall include all costs for the work required to prepare the area for seeding and to hydro-seed and protect the seeded areas.

3. **"Erosion Control, Mulching"**, per square foot.

The Bid item price for "Erosion Control, Mulching" shall include all costs for the work required to furnish and install the specified type mulch.

4. **"Erosion Control, Matting (Type)"**, per square foot.

The Bid item price for "Erosion Control, Matting (Type)" shall include all costs for the work required to furnish and install the specified type matting. All costs to repair and maintain matting and coverings shall be included in this Bid item price.

5. **"Erosion Control, Shear Boards"**, per linear foot.

The Bid item price for "Erosion Control, Shear Boards" shall include all costs for the work required to furnish and install the specified type shear boards.

6. **"Mowing"**, per square yard.

The Bid item price for "Mowing" shall include all costs for the work required to mow and edge the areas indicated in the Contract. When a Bid item for "Lawn Establishment, Minimum Bid (\$___)" is included in the Bid Form, all costs for mowing and edging shall be included in the "Lawn Establishment, Minimum Bid (\$___)" Bid item price (see Section 8-02.5).

7. **"Topsoil, (Type)"**, per cubic yard.

8. **"Mulch, (Type)"**, per cubic yard.

The Bid item prices for "Topsoil, (Type)" and for "Mulch, (Type)" shall include all costs for the work required to furnish and place the specified type topsoil or mulch, including excavating, loading, hauling, windrowing, stockpiling, spreading, cultivating and compacting. Where the addition of lime and other amendment is specified in the Contract, all costs for lime and other amendment shall be considered included in the Bid items "Topsoil, (Type)" or in "Mulch, (Type)".

When the Bid Form includes the Bid item "Topsoil, Type B", the Contractor shall furnish topsoil Type A at no additional cost to the Owner if a shortage of topsoil Type B occurs due to the Contractor wasting or otherwise disposing of topsoil Type B Material.

9. **Other payment information.**

All costs for the Work required to restore, reseed, refertilize, and remulch areas failing to show a uniform stand of grass, as necessary, shall be at the Contractor's sole expense and at no additional or separate expense to the Owner.

Removal for clear plastic covering, when such Material is specified as a method of erosion control, will be addressed as "Extra Work" in accordance with Section 1-04.4.

Payment for sodding as a type of erosion control shall be in accordance with Section 8-02.5.

Payment for furnishing and placing planting soil shall be in accordance with Section 8-02.5.

Material taken from Roadway excavation, borrow, strippings, or other excavations and used for topsoil will not be deducted from the pay quantities for the respective Bid items. *Reseeding areas ordered by the Engineer and not considered the responsibility of the Contractor will be made in accordance with Section 1-04.4.*

Costs for fertilizer, mulch, seed, tackifier, amendment, and other additives shall be considered included in the Bid item prices for the Bid items "Erosion Control, Seeding" and "Erosion Control, Hydro-Seeding".

SECTION 8-02 ROADSIDE PLANTING

8-02.1 DESCRIPTION

Section 8-02 describes work consisting of furnishing, planting, and maintaining for the landscape establishment period such trees, whips, shrubs, ground cover, seedlings, cuttings, and sod as specified in the Contract. Work shall be performed as indicated in the Contract and in accordance with accepted horticultural practices.

This work shall also consist of furnishing and installing such paver blocks, grid blocks, cedar edging, bollards, benches and tree grates as indicated in the Contract.

Trees, whips, shrubs, ground covers, seedlings, cuttings, and sod will hereinafter be collectively referred to as, "plants" or "plant Material".

Plant Material quantity, size and condition, and spacing shall be as indicated in the *Contract*.

All landscaping shall be performed by a licensed Landscaping Contractor registered in the State of Washington.

8-02.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Pressure-Treated Landscape Timbers	9-09.3
<i>Roadside Planting and Related Materials</i>	9-14

Nomenclature for plants and varieties shall be in accordance with the *current* edition of "Standardized Plant Names" as prepared by the American Joint Committee on Horticulture Nomenclature.

Planting Soil shall be used unless otherwise specified in the Contract.

The type of seed mix shall be as specified in the *Contract*.

Planting mulch for topdressing shall consist of bark mulch unless otherwise specified in The Contract.

The concrete mix for wood bollard footings shall be Class 5 (3/4) (See Section 5-05.3).

Grow bags containing plantings (trees, shrubs, and other plant material) will not be allowed.

8-02.3 CONSTRUCTION REQUIREMENTS

8-02.3(1) RESPONSIBILITY DURING CONSTRUCTION

The Contractor shall provide adequate and proper care of all plant Material and landscape Work done on the Project from the time of installation to the end of the landscape establishment period (see Section 8-02.3(12)).

Adequate, proper care shall include, but is not limited to, keeping all plant Material in a healthy growing condition by:

1. weeding, watering, cultivating, pruning, mulching and spraying;
2. keeping all plant Material crowns, runners, trunks and branches free from mulch at all times;
3. keeping planted and landscaped areas free from insect infestation, weeds and grass, litter and other debris;
4. *retaining finished grades in a neat, tidy, uniform condition;*
5. *readjusting grade paver blocks which may have settled;*
5. *adjusting tree fasteners as needed to prevent strangulation or irregular growth of plant Material; and*
6. *maintaining either:*
 - a. *in pedestrian walking areas, a consistent 2 to 3 inch layer of mulch in all planting beds and tree pits, or*
 - b. *in non-pedestrian areas, a consistent 4-inch layer of mulch in all planting beds and tree pits.*

The Contractor shall have sole responsibility for the survival of all plant Material, and operation of newly installed irrigation Equipment when included in the Contract, from the time of installation to the end of the landscape establishment period, with the exception of third party damage or vandalism occurring after the start of the landscape establishment period.

Dead, diseased, dying, or damaged plant material shall be removed and replaced with healthy plants of the same type and size. Replacement plants shall be planted within a time period set by the Engineer, which will depend on the season and availability of the replacement plants. Missing plants shall be replaced by the Contractor in the same manner. The Contractor shall provide the Engineer 2 Working Days advance notice when plant replacement is indicated.

8-02.3(2) RESERVED

8-02.3(3) CHEMICAL PESTICIDES

All pesticide use within the City of Seattle shall be in accordance with the City of Seattle pesticide reduction strategy including restrictions on product selection. Chemical pesticides shall only be used after other pest management techniques have been demonstrated to have no effect. Pesticide information is available on Seattle's website "www.ci.seattle.wa.us" by typing the keyword "pesticide" in the Search mode.

When chemical pesticides are allowed as indicated in the Contract, application of chemical pesticides shall be in accordance with the manufacturer's recommendations and shall be carried out by an experienced applicator. The applicator shall be licensed by the State of Washington for the class of pesticide utilized. The Contractor shall submit to the Engineer evidence that all operators are licensed and the pesticide is registered in the State of Washington. The Contractor shall also submit to the Engineer a copy of the MSDS (Material Safety Data Sheet) and manufacturer's recommendations for each pesticide application to be used.

The Contractor shall use extreme care to ensure confinement of chemicals within the areas designated. The Contractor shall assume all responsibility for rendering any area *unacceptable* for planting by reason of chemical application. Damage to adjacent areas either on or off the Right of Way shall be repaired to the satisfaction of the Engineer, the property owner, or both. Chemicals which leave any residue in the soil and which are toxic to the plant Materials specified in the Contract for planting or to those in adjacent areas shall not be used.

The Contractor shall notify the Engineer at least 48 hours prior to the application of any pesticide, giving the name of the product, rate of application, and where it is to be used.

Trees shall be sprayed with the proper insecticide necessary to control disease, infestation by harmful insects and pests, including the control of caterpillars.

All chemicals shall be delivered to the Job Site in unopened containers.

No spraying shall occur within a 24-hour period of wet weather conditions.

8-02.3(4) PLANTING AREA PREPARATION

Areas to receive plant Material shall be cleared, grubbed, cultivated and graded prior to planting. Weed clearing shall be by non-chemical application methods, unless the application of chemical herbicide for weed control is specified in the Contract. Chemical herbicide shall be applied to vegetated areas prior to clearing and grubbing operations. Planting areas shall be prepared so that they are weed and debris-free at the time of planting and until acceptance by the Owner. Planting areas shall include all planting beds, areas 5 feet in diameter around trees and shrubs, and other areas indicated in the Contract. It is the intent of The Contract to provide the optimum conditions for plant establishment and for growth.

Where it is necessary to establish the subgrade for a planting area, the Work shall be performed in accordance with the requirements of Section 2-03. The elevation of the subgrade shall take into account the requirements, if any, for adding and incorporating Material into the natural soil, including the required quantities of planting soil and soil amendments, plus a minimum of 2 inches of mulch as topdressing. Fills shall be placed in lifts not exceeding 6 inches, with each lift compacted to 85% maximum density, as determined by the compaction control test specified in Section 2-03.3(14)E.

Planting areas shall be graded to finished subgrade and cleaned of all debris including stumps, sticks, roots and rocks or lumps larger than 3 inches and inspected before planting soil or mulch is placed.

After the subgrade of the planting areas has been cleaned and graded, planting soil, decomposed organic mulch amendment, fertilizer, soil conditioners, and/or other amendment as required in the Contract shall be applied at a uniform lift of 3 inches and then rototilled into the subgrade soils over the entire planting area for a 6 inch depth resulting in a 50-50 blend. The 6 inch amended layer shall be compacted to 85% (see Section 2-03.3(14)E). See Section 9-14.4(5) when the required quantity of decomposed organic mulch amendment exceeds 35 cubic yards.

When the finished grade requires more than a 3-inch lift of imported soil, the initial lift shall be a maximum of 3 inches and shall be rototilled into the native subgrade soils for a 6 inch depth resulting in a 50-50 blend. This amended layer shall be compacted to 85%. Subsequent quantities shall be placed in 6" lifts, each compacted to 85%. The final lift shall contain a combination of planting soil, decomposed *organic mulch amendment*, fertilizer, and soil conditioners as required in the Contract, rototilled when required to provide a homogeneous blend. The Contractor shall apply and shape the lifts in such a manner that the planting area has a final surface resulting in uniformly sloped surfaces from a ridge line, or ridge lines, to all outer edges of the planting area where the planting area surface is 2 inches below adjacent surrounding surfaces. The ridge line shall be the approximate centerpoint, or centerline(s), of the planting area as indicated *in the Contract*. Planting soil or decomposed *organic mulch amendment* or both shall not be placed when the ground or planting soil or decomposed *organic mulch amendment* is frozen, excessively wet or, in the opinion of the Engineer, in a condition detrimental to the Work.

The finished grade of planting soil prior to the installation of plant Material shall be 2 inches below the top surface of the adjacent sidewalks or curbs to allow for 2 inches of mulch as topdressing.

8-02.3(5) LAYOUT OF PLANTING

Plants shall be placed at spacings and locations shown *in the Contract*. Location layout and staking shall be the responsibility of the Contractor, subject to the approval of the Engineer, before planting or construction of each item begins.

The Contractor shall locate trees first, then place the plants starting from the perimeter of the bed area and progressing to the center so that odd dimensions are adjusted at the centers of any planting bed as shown in the Contract.

8-02.3(6) PLANTING

8-02.3(6)A GENERAL

Plants brought to the planting site shall be bare root, balled and burlapped, or in containers, depending on how specified in the planting schedule *in the Contract* for the particular type of planting Material. No plant Material shall be planted until it has been inspected and approved for planting by the Engineer. Plants shall not be planted during freezing weather or when the ground is frozen. Plants shall not be planted during excessively wet conditions. Plants shall not be placed in areas that are below finished grade.

Dates to plant Unless the Contract specifies otherwise, planting trees, shrubs, and groundcovers shall be

performed during the period between October 1st and April 30th.

Where soil berms or planting saucers are not indicated in the Standard Plans, drainage away from planting holes shall be provided for all newly installed plants. A differing site condition may exist, per Section 1-04.7, if in excavating a planting hole or in preparing to install plant material in a planting hole, ground water is discovered. Should ground water be discovered, the Contractor shall not proceed with planting and shall promptly make the notification in accordance with Section 1-04.7. Should the Contractor make the planting when ground water is evident and without notifying the Engineer in accordance with Section 1-04.7, the Engineer upon discovering this condition may make the determination of defective or unauthorized Work in accordance with Section 1-05.7. Where subsurface drainage is required in the Contract, the subsurface drainage installation shall be inspected and approved by the Engineer prior to planting and backfill.

Bare root plants shall be protected at all times to prevent drying.

Bare root plants which cannot be planted within 24 hours after arrival at the Project Site shall be removed from shipping containers and heeled-in. The temporary protective medium for heeling in the plant Material shall be peat moss or sawdust and shall be kept continuously moist. Damaged or torn roots shall be cut cleanly before planting.

Plants supplied in containers shall be kept moist at all times and shall be removed from the container in a manner that prevents damage to the root system. The plants shall not be removed from the container by pulling on the stem. Non-tapered containers larger than 5 gallon size shall have 2 vertical cuts made down the entire depth of the container before the root ball is removed. Representative samples of all containerized Material shall be inspected by the Engineer upon removal from the container. All circling roots shall be cut and straightened to ensure correct directional growth after planting. The Engineer may require that the entire root ball be split from the bottom for a depth equal to 1/2 the container depth to expose root ends to the soil in the planting hole. In their final position, containerized plants shall have the same relationship to finished grade as when growing in the container.

8-02.3(6)B TREES

Tree planting holes shall be excavated to the depth of the rootball over a minimum surface area of two (2) times the rootball diameter and the depth of the rootball less 2 inches. Tree pit excavation near a curb or sidewalk shall allow a horizontal clearance of at least 3 inches from the curb or sidewalk. One-third cubic yard of decomposed organic mulch amendment shall be added and thoroughly mixed with excavated soils to provide an amended homogeneous mix for backfilling the excavation.

The Contractor shall provide the Engineer at least 1 Working Day advance notice of the first tree to be planted. The Engineer shall be present for the planting of the first tree.

Trees shall be placed with the root crown 2 inches above the surrounding curb and sidewalk grade. Care shall be taken not to over-excavate. Once in position, the twine and burlap or wire basket shall be removed from the top 2/3 of the root ball. Bare root plants shall be placed in the planting hole with roots spread out in a natural position and shall not be bunched, curled, twisted or bent. Backfill operations, watering, mulching, etc. shall be as described for container plants or balled and burlapped plants.

Backfill shall be carefully compacted by foot pressure applied to the soil. Under no circumstances shall water-saturated soil be used for backfill. *Upon completion of backfilling, the Contractor shall build a 3 inch to 4 inch high, 5 foot minimum diameter soil berm or soil saucer (watering ring) around the tree to contain and allow slow percolation of water to the root system. The diameter of the soil berm may vary from 5 feet in accordance with Standard Plan nos. 100a, 100b, and 101. Water shall be applied at a rate of 15 to 20 gallons per tree per week. If settling occurs, the Contractor shall add enough soil to cover the roots but shall not rework the soil. Three inches of mulch shall then be added to topdress the entire tree pit including the watering ring, with the depth tapered to minimize contact at the trunk. In their final position, trees shall have their root crowns positioned above the surrounding grade as indicated on the Standard Plans.*

8-02.3(6)C SHRUBS AND GROUNDCOVERS

Planting holes for containerized shrubs and groundcover plants shall be excavated as shown in the Standard Plans. Dry backfill soil shall be firmly compacted and bermed around the root system to form a watering ring for each plant. Plants shall be watered immediately after planting. *Mulch shall be added to a 2-inch minimum depth. After mulch application, the Contractor shall provide the Engineer at least 1 Working Day advance notice prior to planting groundcover(s).*

Balled and burlapped shrubs shall be set in planting holes as shown in the Standard Plans with the burlap and tie materials entirely removed.

8-02.3(7) PRUNING AND STAKING

In constructing pavement, sidewalk, curb, or curb and gutter, should tree roots 2 inch or greater diameter be encountered, the Contractor shall promptly notify the Engineer as specified in Section 1-07.16(2).

All plants shall be pruned at the time of planting to remove any minor broken or damaged twigs and branches. Pruning shall be done in such a manner as to retain or to encourage the natural growth characteristics and proper form of the plants. Pruning shall be done with a sharp tool to produce a clean cut without bruising or tearing the bark. *All completed pruning cuts shall be in the living wood where callous tissue can develop properly.*

All tree trimming shall be done by an arborist, or a trained arboricultural technician working under the direction of an arborist from a professional tree service company which adheres to the National Arborist Association's tree pruning standards.

Tree pruning Work shall be divided as follows:

1. Minor pruning Work is limited to:
 - a. removal of less than 10 percent of the foliage, or if foliage has not developed, less than 10 percent of the foliage buds including branches up to 1-1/2 inches diameter; and

- b. *removal that does not adversely impact the central leader or does not significantly alter the natural form of the tree being pruned.*
- 2. Major pruning Work is all other pruning Work. When major tree pruning Work is required, the Contractor shall:
 - a. Notify the Engineer 3 Working Days prior to start of pruning and provide the name of the company or individual(s) proposed for doing the pruning. All major pruning Work shall be done by an arborist certified by the Washington State Chapter of the International Society of Arboriculturists.
 - b. *Arrange with the arborist and the Engineer a time at least 2 Working Days in advance, before starting the pruning so that the Engineer can observe and approve the pruning of the first tree. This tree shall be representative of the trees to be pruned and shall be adequate demonstration of the proper pruning method to apply to all the trees. After the Engineer has approved the representative tree pruning, the Contractor's pruner may proceed with pruning the remaining trees.*

Unless otherwise specified in the Contract, all deciduous trees shall be staked at the time of planting by "Method A". Method A requires two 2-inch diameter doweled pressure-treated wood stakes with chamfered tops and 6-inch conical points as indicated in Standard Plan no. 100a. *When tree grates are required in the Contract, then either tree staking by Method B using a single 5/8-inch diameter deformed steel reinforcing bar, or tree staking by Method A will be indicated in the Contract.* For deciduous tree installation, the stake shall penetrate a minimum of one foot into undisturbed subgrade with the top of the stake extending up to 2 inches below the lowest lateral branch or five feet above finished grade, whichever is tallest. For needle-bearing trees, a single doweled tree stake shall be provided with length adequate to allow for a minimum penetration of one foot into undisturbed subgrade and the top of the stake extending approximately to two-thirds of the tree height.

Damaged stakes shall be removed and replaced. Any tree or shrub thrown out of plumb by wind action or other causes shall be replanted by loosening the soil around the root system and replumbing the tree or shrub by adjusting the position of the root system. Adjustment shall not be made by pushing, pulling or restraining the trunk or stem. If, in the opinion of the Engineer, damage to the root system has occurred as a result of re-plumbing a tree or shrub, the tree or shrub shall be replaced by the Contractor.

Alternate methods of staking may be proposed by the Contractor, and, if approved by the Engineer, may be used.

Methods A and B for staking shall provide support for the tree trunk utilizing #2 "chain lock" tree ties, or approved equal, and shall provide a minimum clearance of 1/2-inch on all sides of the trunk to allow for growth and flex of the tree trunk.

8-02.3(8) FERTILIZERS

Unless otherwise specified *in the Contract*, fertilizers for trees shall be a balanced formulation plus micronutrients controlled-release NPK in slow release form with a duration of availability greater than 6 months and shall be subject to approval by the Engineer. Fertilizer shall be formulated as described in Section 9-14.3(1). One cup of fertilizer shall be applied both at the beginning and the end of the plant establishment period within a 4-foot diameter circle around each tree.

Unless otherwise specified *in the Contract*, fertilizer for shrubs and ground cover shall be the same formulation as above but applied at the rate of 1/2 cup per shrub and 1/4 cup per ground cover plant both at the beginning and at the end of the plant establishment period and spread within a 4 foot diameter circle around each plant.

8-02.3(9) MULCH AMENDMENT

Planting mulch amendment shall be as specified in Section 9-14.4(4) Fertile Mulch, or 9-14.4(5) Decomposed Organic Mulch, as called for in the Contract. If the Contract does not specify the type mulch amendment, then decomposed organic mulch amendment shall be used. Decomposed organic mulch, when used in planting bed preparation, shall be applied to a settled lift thickness of 3 inches, rototilled into a 3-inch depth of underlying subgrade soil to obtain a 6 inch deep 50/50 percent blend of mulch and subgrade soil unless otherwise specified in the Contract. Wood chips, salvaged from clearing and grubbing operation, may be used as a bark mulch for topdressing if so indicated in the Contract or as allowed by the Engineer. Fertile mulch may be used for topdressing if specified in the Contract.

8-02.3(10) SOIL AMENDMENTS

Soil amendments of the type and in the quantities specified in the Contract shall be applied during planting area preparation (see Section 8-02.3(4)) for amending the topsoil to the required condition as determined by soil testing. The soil amendments shall be thoroughly mixed with topsoil or mulch or both to produce a uniform blend as indicated in the Contract. All amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis and name. In lieu of containers, amendments may be furnished in bulk, and a Manufacturer's Certificate of Compliance indicating the above information shall accompany each delivery. Cost for amendments required to provide an adequate medium for plant growth shall be incidental to the Bid item for topsoil or decomposed organic mulch amendment.

8-02.3(11) CULTIVATION AND CLEANUP

Upon completion of planting, all excess Material shall be removed from the Project Site and disposed of. Planting areas shall be graded flush to 1 inch below walks, curbs, pavements and driveways.

8-02.3(12) LANDSCAPE ESTABLISHMENT

- 1. **General:** Landscape establishment shall consist of providing adequate and proper care for all plant Materials and landscape areas within the *Project Site* during the landscape establishment period to assure the resumption of growth of the transplanted Material. *The landscape establishment period shall begin on the date of Written Notice from the Engineer of the acceptance of planting for the entire Project, including the acceptance of the automatic irrigation system (if included in the Project), and shall end 365 calendar Days thereafter unless the Contract specifies otherwise. The Contractor shall be held responsible for the*

- loss of any plant Material, whether dead or missing, from the time of initial planting to the beginning of the landscape establishment period. The Contractor shall replace all dead or missing plants before the initial planting will be accepted including all plants stolen or damaged by acts of others.
2. **Application of Herbicides and Insecticides:** Applications shall be as specified in Section 8-02.3(3).
 3. **Watering:** Plants shall be watered by the Contractor as needed to keep them in a healthy growing condition. For hand-watered trees a minimum of 15 gallons per week is required. The Contractor shall be responsible for the watering patterns and timing, including the setting of automatic sprinkler controls. Automatic irrigation systems shall be operated fully automatic during the plant establishment period. *Automatic watering shall be performed during the time period of 4 AM to 7 AM unless otherwise specified in the Contract.* If water restrictions are established, the Contractor shall develop watering schedules in consultation with the Engineer. *The Contractor will not be permitted to use Owner hydrants for direct watering purposes; however, hydrants may be used to fill a water tank or truck pursuant to the requirements of Section 2-07.* Before commencement of the landscape establishment period, the Contractor shall furnish in writing a watering schedule to the Engineer. Any change in watering schedule shall require a minimum 1 Working Day advance notice to the Engineer. All irrigation system components installed as part of the Work shall be maintained and operated by the Contractor as part of the Landscape Establishment Work.
 4. **Mulch:** *Mulch topdressing shall be applied to a 3 inch loose lift and shall be maintained at a 3 inch loose lift with the addition of additional topdressing mulch when needed. The final mulch application, if needed, shall be made 1 week prior to inspection for acceptance.*
 5. **Fastenings:** Tree fastenings shall be kept intact and effective in maintaining firm support for plant Material. Fastenings shall be adjusted as needed by the Contractor to prevent strangulation or irregular growth. Fastenings and stakes shall be removed at the completion of the *first year* establishment period. Wood stakes shall remain the property of the Owner and arrangements shall be made by the Contractor to provide for their delivery to an Owner storage facility identified by the Engineer.
 6. **Inspection of Work:** A general cleanup shall be made after any Work performed by the Contractor at the Project Site during the landscape establishment period.
 7. **Litter Removal:** Unless otherwise specified in the Contract, the Contractor shall remove all litter, as a minimum, to provide a clean appearance at the time of landscape establishment inspections (*see item 9 this Section*). The Contractor shall notify the Engineer on the same Day that litter pickup has been provided to ensure full credit for litter removal Work required in the Contract.
 8. **Weed Control:** The Contractor shall maintain all mulched bed areas around trees, shrubs, and groundcovers in a weed free condition during the landscape establishment period. A combination of chemical and mechanical control shall be allowed subject to approval by the Engineer. At least 5 Working Days before the beginning of the landscape establishment period, the Contractor shall submit a weed control program identifying the means, manner, methods, and timing intervals to assure weed control. This weed control plan will be subject to revision dependent on results of the implemented plan.
 9. **Inspection:** Plants and landscaped areas will be inspected regularly by the Engineer during the landscape establishment period. Should the Engineer determine at any time that the Contractor is not providing adequate and proper care of plant Material or is performing substandard landscape establishment Work, the Engineer will order the Contractor in writing to correct and remedy such *unacceptable* Work or practices. The Contractor shall make the necessary corrections within a 5-Day period immediately following receipt of such notice. Notice will be made in writing to the Contractor or the Contractor's representative following inspection of the Project Site. Plant Material listed as dead, missing, or unacceptable, shall be removed, disposed of, and replaced by the Contractor according to a schedule set by the Engineer.

Approximately 30 Days before the end of the landscape establishment period, the Contractor may be required to accompany the Engineer or the Assistant on a walking inspection of the Project. Conditions found unacceptable by the Engineer shall be corrected by the Contractor within a 10-Day period immediately following the inspection. After correction, the Contractor shall notify the Engineer for a reinspection. Corrective Work shall include replacement of dead, missing, or *unacceptable landscaping* Material, weeding, pick-up of all litter, and repair of irrigation system.

8-02.3(13) PLANT REPLACEMENT

The Contractor shall be responsible for growing or providing enough plants for replacement of plant Material rejected before and through the plant establishment period. Rejected plant Material shall be removed and replaced as specified in Section 8-02.3(12).

All replacement plants shall be of the same species, size and quality as the plants they replace.

Relocated trees larger than 4-inch caliper that fail to survive shall be replaced with a minimum of 3-1/2 inch caliper tree approved by the Engineer. Difference in value between relocated tree and replacement tree shall be assessed by the Engineer per Section 8-02.3(22).

8-02.3(14) LAWN INSTALLATION

8-02.3(14)A GENERAL

Lawn installation shall be by sodding unless "Seeded Lawn Installation" is specified in the Bid Form, and shall include Lawn Establishment as specified in Section 8-02.3(15) when specified in the Bid Form.

In areas irrigated by a sprinkler system, lawn installation shall not begin until the sprinkler system is operational. The Contractor may request the Engineer to approve the option of sodding in lieu of seeding for lawn installation. However, seeding in lieu of sodding will not be allowed.

Playfield soil or decomposed *organic mulch amendment* for both seeded or sodded lawns shall be placed at a uniform thickness to meet finish grade. Decomposed *organic mulch amendment* shall be rototilled with the subsoil to obtain a 25-75 blend, compacted to 85% per Section 2-03.3(14)E, and raked to a smooth even grade without low areas to trap water. Lime shall be incorporated at the time of cultivation at the rate of 100 pounds per 1000 square feet.

Barriers shall be erected, with warning signs where necessary, to preclude *Traffic* across newly placed lawn areas during the establishment period.

Finish grade shall be considered as being 1 inch below the adjacent sidewalk, curb or other Street improvements.

8-02.3(14)B SEEDED LAWNS

Seeded lawn installation shall proceed through the following sequence of steps in its construction:

1. Areas to receive seed shall be cleared and grubbed, and the surface graded to a uniform level surface, 1 inch below curb and sidewalk elevation.

If the surface is at finish grade and the existing soil is deemed suitable for seeding by the Engineer, no planting soil or decomposed *organic mulch amendment* will be required. Where fill is required, playfield soil shall be provided to bring the surface to final grade.

If the existing soil is unacceptable for seeding, the Contractor shall remove enough Material to allow for the placement of 2 inches of playfield soil to bring the surface to the finish grade for seeding (1" of decomposed *organic mulch amendment* may be substituted for 2" playfield soil when approved by the Engineer).
2. After the playfield soil, or decomposed *organic mulch amendment*, have been spread to the thickness specified and lime has been added at the rate of 100 pounds per 1000 square feet, the area shall be mechanically tilled with subgrade soils to a depth of 4 inches. Soil shall then be raked by approved hand or mechanical methods to remove all large clods, rocks, debris, and litter over 1 inch in any dimension which shall be disposed of by the Contractor.
3. The area shall then be rolled in 2 directions, the second rolling at right angles to the first. The roller shall be of a standard, waterfilled type to apply 150 to 300 pounds per square foot ground pressure.
4. The finished grade shall be 1/2-inch below all curbs, sidewalks, and other appurtenances.
5. Apply a 10-10-10 fertilizer at the rate of 15 pounds per 1,000 square feet. The fertilizer shall be applied by an approved hand or mechanical method. Application in one direction is sufficient.
6. *Apply the Contract specified lawn seed mix described in Section 9-14.2.*
7. Rake seed and fertilizer into the top 1/2 to 1 inch of soil.
8. Roll the area in 1 direction.
9. Water thoroughly.

NOTE: Items 5 to 9 may be accomplished by hydro-seeding as described in Section 8-01.3(4)A.

8-02.3(14)C SODDED LAWNS

A sod installation shall proceed through the following sequence of steps in its construction:

1. Areas to receive sod shall be cleared and grubbed and the surface graded to a uniform level surface 1 inch below adjacent curbs and sidewalks. *If the cleared and grubbed surface is at or near required grade to receive sod and the existing soil is determined acceptable by the Engineer, no planting soil or decomposed organic mulch amendment will be required. If the existing soil is determined unacceptable for sodding, the Contractor will be required to remove enough Material to allow for placement of 2 inches of playfield soil to bring the surface to finish grade (1" of decomposed organic mulch amendment may be substituted for 2" playfield soil when approved by the Engineer).*
2. *After the planting soil or decomposed organic mulch amendment, have been spread to the thickness specified and lime has been added at the rate of 100 pounds per 1000 square feet, the area shall be mechanically tilled with native soils to a depth of 4 inches or more to produce a 50-50 homogeneous blend.*
3. The area shall then be raked by approved hand or mechanical methods in order to remove all large clods, rocks, debris, and litter (over 1 inch in size) to be disposed of by the Contractor.
4. The area shall then be compacted by rolling in two directions. The second rolling shall be done at right angles to the first. The roller shall be of a standard, water-filled type applying 150-300 pounds per square foot ground pressure. The grade after compaction shall be such that the root crown of the sod is flush with the finish grade.
5. Immediately prior to placement of sod, a 10-10-10 fertilizer (per Section 9-14.3(1)) shall be raked into the soil at a rate of 15 pounds per 1,000 square feet. The fertilizer shall be applied by approved hand or mechanical methods. Application in one direction is sufficient.
6. The sod strips shall be placed within 48 hours after being cut. Soil shall be moistened by sprinkling prior to the laying of the sod. Sod shall be placed without voids and shall have the end joints staggered. The root crown shall be set to the grade of the sidewalk or curb. Butt joints shall be staggered and tightly fitted. On sloped areas, sod shall be laid with the long dimension across the slope, parallel to the top or toe of the slope. When installing sod to restore partially disturbed lawn areas, the Contractor shall set the root crown of the new sod flush with the root crown of the adjacent lawn. Areas of existing lawn bordering on partial lawn restorations shall be hand-seeded and top-dressed with a mixture of 50 percent sand and 50 percent decomposed *organic mulch amendment*. Such areas, not more than 2 to 4 feet in width, shall constitute a smooth transition between new and existing stands of grass.
7. Following placement, the sod shall be rolled with a smooth, water-filled type roller. After rolling, the sod shall be heavily watered by sprinkling. Lawn areas shall be uniformly level.

8. *When called for in the Contract*, the Contractor shall apply a mixture of 50 percent sand and 50 percent decomposed *organic mulch amendment* to fill voids between sod strips.
9. The Contractor shall commence watering immediately as specified in Section 8-02.3(15). Watering and fertilizing shall be the Contractor's responsibility during the lawn establishment period. Watering shall be scheduled to prevent drying of joints between the sod strips.

8-02.3(15) LAWN ESTABLISHMENT

Lawn establishment shall consist of providing adequate and proper care for all public and private lawn areas installed within the limits of the Project. *The lawn establishment period shall begin upon acceptance by the Engineer based upon both a uniform stand of grass as described in 8-01.3(10) and upon completion of a first mowing.* Lawn Establishment shall extend for a minimum of 90 Days during the active growing season (defined as consecutive Days from April 30th to October 30th). During the lawn establishment period, the Contractor shall provide adequate and proper care to ensure the continuing healthy growth of the turf. *Adequate and proper care shall include the labor, Materials, and Equipment necessary to keep the planted areas in a presentable condition including, but not limited to, mowing, trimming, acceptable quantities of grass clippings as mulch, litter and debris removal, edging, fertilization, weed control, repair and reseeding damaged areas, and repairing and keeping in operation irrigation systems installed as part of the Work. When the Contract specifies insecticide and fungicide applications in lawn establishment, the application shall be in accordance with manufacturer's recommendations which the Contractor shall submit to the Engineer for review at least 5 Working Days prior to use.*

As a part of lawn establishment, the Contractor shall comply with the following minimum requirements:

1. *Mowing and edging shall be done as often as conditions dictate. Maximum height of lawn shall not exceed 3 inches. The cutting height shall be 1 1/2-inches with all cuttings removed.*
2. A slow-release form of nitrogen fertilizer shall be applied at the end of the lawn establishment period, rate of application and formulation per Section 9-14.3(1). Fertilizer shall be thoroughly watered in.
3. Watering shall be accomplished each week from March through September and shall be done only at night or early morning. A uniform application of 1 inch of water minimum shall be required over all lawn areas per week. The Contractor shall adjust the rate and frequency of water application, as designated by the Engineer, depending on weather and soil conditions.
4. Temporary barriers shall be removed after the grasses have developed into a heavy sod mat and only on written permission from the Engineer.
5. Lawn areas will be inspected regularly by the Engineer during the lawn establishment period. Should the Engineer determine at any time that the Contractor is not providing adequate and proper care of the lawn or is performing substandard lawn establishment Work, the Engineer will order the Contractor in writing to correct and remedy such *unacceptable* Work or practices. The Contractor shall make the necessary corrections within a 5-Day period immediately following receipt of such notice. Notice will be made in writing to the Contractor or the Contractor's representative following inspection of the Project Site. Acceptance of lawn planting as specified herein shall be based on a uniform stand of grass at uniform grade at the end of the lawn establishment period. Areas that are bare, have a poor stand of grass, or do not have a uniform grade through any cause shall be regraded, reseeded or resodded and refertilized. Dead or dying sod or sod with brown spots will be rejected.

Approximately 10 Days before the end of the lawn establishment period, the Contractor may be required to accompany the Engineer or the Engineer's representative on a walking inspection of the Project. Conditions found unacceptable by the Engineer shall be corrected by the Contractor within a 10-Day period immediately following the inspection. After correction, the lawn establishment period shall extend an additional 45 Days including the requirements listed in items 1 through 4 above.

All Work performed under lawn establishment shall be performed by qualified turf management personnel and shall comply with good turf management practices.

8-02.3(16) INSTALLING REMOVABLE PAVER BLOCKS IN TREE CUT-OUTS

The Contractor shall install paver blocks of the size and type specified at the locations shown *in the Contract*. Paver blocks shall be installed after the trees have been planted and the tree pits backfilled and compacted to a finished grade to allow for the paver blocks to be below the top surface of adjacent sidewalk. A bed of compacted sand shall be used as a setting bed for the pavers.

The top surface of the pavers shall be set flush with the adjacent sidewalk. All voids between pavers and sidewalk and between pavers shall be filled with sand. The installation method shall provide a secure edge adjacent to the tree trunk to ensure that pavers remain in place. If for any reason paver installations in the tree pits become loosened or dislodged during the landscape establishment period, the Contractor shall restore the installation to a condition acceptable to the Engineer. Excess sand and dirt shall be swept up and disposed of. *The Contractor shall comply with the requirements of Sections 1-07.5 and 1-07.15 regarding prevention of environmental pollution and preservation of public natural resources, and temporary water pollution/erosion control, and with Project permit requirements as applicable.*

8-02.3(17) GRID BLOCKS

The Contractor shall install grid blocks of the type specified in areas shown in the Contract. Areas receiving grid blocks shall be excavated, graded and compacted to a minimum depth of 8-inches below the top surface of adjacent sidewalks and curbs. After the subgrade has been approved, the Contractor shall install a sub-base of Mineral Aggregate Type 1 to a compacted average depth of 6 inches. Compaction shall be to a 95% maximum.

Thereafter, a 2-inch sand setting bed shall be spread and tamped or rolled on top of the crushed rock base. The grid blocks shall then be placed on the sand bed and each block leveled with each adjacent block. The top of the blocks shall be laid flush with the top surface of adjacent sidewalks and curbs. After the blocks have been installed and leveled, *joint filling sand per Section 9-14.9(13)* shall be spread and worked into all voids. The area receiving grid blocks shall thereafter be seeded with grass seed of the type and in the quantity *specified in the Contract*.

8-02.3(18) EDGING

8-02.3(18)A EDGING, CEDAR

The Contractor shall install cedar edging for each cut-out as required and indicated *in the Contract*. Edgings shall be installed on edge with the top of the form level with the top of the existing grades or the top of the existing adjacent concrete sidewalks and curbs. Forms shall be secured with 2-inch by 2-inch by 12-inch cedar stakes in accordance with the detail shown in the Contract, driven to the inside of the forms and attached to the cedar edging with eight penny galvanized common nails.

8-02.3(18)B EDGING, PAVER RESTRAINT SYSTEM

Where a paver edge restraint system is shown *in the Contract*, the Contractor shall prepare the soil subgrade, place and compact the base course (if required), and install the paver edge restraint system in accordance with the manufacturer's instructions. The edging shall be black or dark in color. For added support, selected Material or planting soil shall be placed against the restraint system before pavers are installed. The paver restraint system shall be inspected and approved by the Engineer before any backfilling occurs.

8-02.3(18)C EDGING, PRESSURE-TREATED LANDSCAPE TIMBERS

The Contractor shall install 6-inch by 8-inch pressure-treated landscape timbers as required and indicated *in the Contract*. Timbers shall be installed on the 8-inch base with the top of the timber flush with the top of the concrete sidewalk or the interlocking pavers or finished surfacing as indicated *in the Contracts*. Timbers shall be secured with four No. 4 by 30-inch long reinforcing steel bars placed along the centerline axis and driven flush with the timber surface. Reinforcing steel shall be provided minimum 2' on center. Each timber shall have a minimum of 2 reinforcing steel bar. The Contractor shall arrange the timber edging such that no individual timber length is less than 4 feet.

Pressure-treated landscape timbers will not be allowed as paver restraint for tree pits.

8-02.3(19) BOLLARDS

8-02.3(19)A GENERAL

The Contractor shall install bollards of the type specified in the Contract. Bollards shall be installed where indicated on the Drawings and in accordance with the requirements specified in the Contract.

Bollards shall be installed true to line and grade and set in a plumb position.

The Contractor shall furnish one padlock with each removable bollard. Padlock cores shall be provided as indicated in the Contract.

8-02.3(19)B WOOD BOLLARDS

The tops of concrete footings for wood bollards shall be formed and troweled level with surrounding surfaces.

8-02.3(19)C CONCRETE BOLLARDS

The Contractor shall construct reinforced concrete bollards where shown in the Contract. Bollards shall be of the size and shape indicated on the Drawings.

Bollards shall be set in excavated holes true to line and grade in a plumb position with backfill thoroughly tamped around them.

8-02.3(19)D STEEL BOLLARDS

The Contractor shall construct steel bollards where shown in the Contract. Bollards shall be of the size, material, and shape indicated in the Contract.

Bollards shall be set in excavated holes true to line and grade in a plumb position with suitable backfill thoroughly compacted around them.

8-02.3(20) BENCHES

The Contractor shall install benches of the type indicated and as located in the Contract. The Contractor shall provide at least 1 Working Day advance notice prior to placement to the Engineer of proposed bench locations for verification.

8-02.3(21) TREE GRATES

The Contractor shall install tree grates at locations indicated *in the Contract*. *Tree grates shall meet the requirements of Section 9-14.14.*

The tree pit opening in concrete sidewalk shall be sized to accommodate the tree grate. The tree grate shall be supported by an angle iron frame, with a horizontal tolerance of 1/4-inch between grate edges and vertical legs of the angle iron support frame. This frame shall be dimensioned for compatibility with the grate, and shall typically consist of legs which are 1-inch by 1-inch by 1/4-inch structural shapes, mitered and welded at the corners. To secure the steel frame in place, anchors made of No. 4 reinforcing bars 6 inches long shall be welded to the horizontal bottom leg of the angle iron frame at 18-inch centers, and embedded in the concrete sidewalk. The grates shall be sized to have a minimum of 1/2-inch bearing on

each horizontal angle frame leg. Top of grates shall be flush with top of adjacent sidewalk. A continuous tooled scribe line shall be made in the concrete sidewalk, 6 inches from and parallel to each leg of steel angle around the tree opening. Where tree grates are adjacent to curb, the scribe line shall end at the curb.

Concrete sidewalk placed against the tree grate frame shall have a thickened edge surrounding the grate. The thickened edge shall be 8 inches wide with the depth of thickened edge nearest the grate being 8 inches deep for a width of 4 inch. The thickened edge thickness shall taper to sidewalk thickness in the remaining 4 inch width.

When concrete collar is detailed on the Drawing in lieu of thickened edge, such collar shall be no less than 8 inches deep by 8 inches wide, and shall be separated from the sidewalk pavement by a through joint. The angle iron frame details and anchorage *will be indicated in the Contract.*

8-02.3(22) RELOCATE TREE

The Contractor shall perform the Work in accordance with good nursery practice. *The tree shall be relocated while in a dormant state (after November 1 or first frost whichever occurs first, and before April 1).*

The tree to be relocated shall be dug by hand or approved machine. The Contractor shall exercise extreme caution when working within the drip line of the tree to avoid damage to the trunk, branches or root structure. The Contractor shall be held liable for damage to adjacent plant Material. *The root ball shall be formed in such a manner so as to encompass the entire fibrous root system including the tap root within the circle diameters given for corresponding tree trunk diameters in the following table:*

Tree Trunk Size	Min. Root Ball Diameter
2 - 4 inches	2-1/2 feet
4 - 5 inches	4 feet
5 - 7 inches	5 feet
7 - 10 inches	6 - 7 feet

The depth of the root ball shall be no less than 1/2 of the diameter listed above. Exposed tree roots of 1-inch diameter and more shall be cut clean before wrapping the root ball. *The root ball and moisture protecting medium shall be thoroughly wrapped with burlap and laced with 1/4-inch polypropylene rope, and shall be kept continuously moist until planted.*

Tree removal work shall be performed with the Engineer present. The Contractor shall handle the tree by the root ball only. Under no circumstances will the Contractor be allowed to lift or remove the tree by the trunk. The tree shall be carefully reset into the designated tree pit and planted in the same manner as a new tree. *At all times, the tree root system shall be kept moist.*

The requirements of landscape establishment of Section 8-02.3(12) shall apply to relocated trees. *If a relocated tree is damaged and does not reasonably and acceptably establish itself after relocation, then the Contractor shall replace the tree at the sole expense of the Contractor. Replacement trees, if necessary, shall be provided in a minimum 3.5 inch caliper size and shall be installed as specified for new trees (see Section 8-02.3(6)B). When the replacement tree is smaller in caliper than the relocated tree to be replaced, then the Contractor shall reimburse the Engineer for the difference in value between the in accordance with the "Guide For Establishing Values of Trees and Other Plants" prepared by the Council; of Tree and Landscape Appraisers, current edition. Removal and disposal of unacceptable trees shall be the responsibility of the Contractor.*

8-02.3(23) TREE ROOT PRUNING PROCEDURE

See Section 1-07.16(2).

8-02.3(24) TUNNELING OR TRENCHING, AND TREE ROOTS

See Section 107.16(2).

8-02.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Tree, (Type), (Size)", for "Shrub, (Type), (Size)" and for "Ground Cover, (Type), (Size)" will be per each type and size plant Material accepted by the Engineer. See Section 9-14.6(1) for typical Bid item plant descriptions.

Seeded lawn and sod installations will be measured by ground slope measurement in square feet of actual lawn completed, established, and accepted.

Measurement for "Planting Soil", and for "Mulch, (Type)" will be per cubic yard.

Measurement for concrete collar will be as specified in Section 8-14.4 for "Sidewalk, Thickened Edge".

8-02.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-02 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Tree, (Type), (Size)",** per each.
2. **"Shrub, (Type), (Size)",** per each.
3. **"Ground Cover, (Type), (Size)",** per each.

The Bid item price for "Tree, (Type), (Size)", for "Shrub, (Type), (Size)", and for "Ground Cover, (Type), (Size)" shall include all costs for the Work required, and not otherwise provided for in other Bid items in this Specification Section, to

furnish, plant, fertilize, cultivate, mulch, stake and maintain the size and type of planting until the initial acceptance of the planting.

4. **"Landscape Establishment, Minimum Bid (\$ _____)"**, per lump sum.

The Bid item price for "Landscape Establishment, Min. Bid (\$ _____)" shall include all costs for the work required to establish the landscape including all costs for the work required to replace unacceptable plant Material, to furnish and to apply water including all costs associated with Section 2-07, and to weed. Should the Contractor determine that the cost for this work is greater than the Bid item lump sum minimum price listed in the Bid Form, the Contractor may bid a higher Bid item lump sum price by crossing out the Bid item lump sum minimum price and extension shown in the Bid Form, writing in a higher Bid item lump sum price and extension in the Bid Form, and initialing the change. Bids received on this Contract which contain a cost for landscape establishment of less than the Bid item lump sum minimum price shown in the Bid Form will be revised to reflect the Bid item lump sum minimum price allowed including the extension and shall govern as becoming a part of the Bid. Payment shall be made at the rate of 25 percent of the Bid item lump sum price for "Landscape Establishment Min. Bid (\$ _____)" at the following periods: May 31, July 31, September 30 and the final 25% at the end of the landscape establishment period after the necessary corrections and replacements have been made. The Contractor shall submit a statement on the 25th of May, 25th of July and the 25th of September including the schedule for work provided to maintain the plantings during that period.

5. **"Planting Soil"**, per cubic yard.

6. **"Playfield Soil"**, per cubic yard.

The Bid item price for "Planting Soil" and for "Playfield Soil" shall include all costs for the work required to furnish, mix, place and grade the specified type soil.

7. **"Mulch, (Type)"**, per cubic yard.

The Bid item price for "Mulch, (Type)" shall include all costs for the work required to furnish, install and rototill the specified type mulch.

8. **"Paver Block, (Size)"**, per each.

The Bid item price for "Paver Block, (Size)" shall include all costs for the work required to furnish and install the specified type paver block.

9. **"Grid Block"**, per square foot.

The Bid item price for "Grid Block" shall include all costs for the work required to furnish and place the grid including crushed rock base, sand setting bed, planting soil and seed.

10. **"Edging, (Material)"**, per linear foot.

The Bid item price for "Edging, (Material)" shall include all costs for the work required to furnish and install the specified type edging.

11. **"Bollard, (Type)"**, per each.

The Bid item price for "Bollard (Type)" shall include all costs for the work required to furnish and install the specified type bollard and shall include the padlock for removable bollard.

12. **"Bench"**, per each.

The Bid item price for "Bench" shall include all costs for the work required to furnish and install the specified size and type bench.

13. **"Tree Grate"**, per each set.

The Bid item price for "Tree Grate" shall include all costs for the work required to furnish and install the specified tree grate including the thickened sidewalk edge or collar and iron frame as indicated in the Contract. See Section 8-14.5 regarding payment for sidewalk collar as "Sidewalk, Thickened Edge" to support the tree grate.

14. **"Relocate Tree"**, per each.

15. **"Relocate Shrub"**, per each.

16. **"Relocate Ground Cover"**, per each.

The Bid item price for "Relocate Tree", for "Relocate Shrub", and for "Relocate Ground Cover" shall include all costs for the work required to remove, protect, store and replant the tree, shrub, or ground cover.

17. **"Sodding"**, per square foot.

18. **"Seeded Lawn Installation"**, per square foot.

The Bid item price for "Seeded Lawn Installation" and for "Sodding" shall include all costs for the work required to prepare the area, seed or sod the lawn, and establish the lawn area. If no Bid item for Lawn Establishment is included in the Bid Form, all costs for lawn establishment shall be included in the Bid item price for the Bid item "Sodding" or "Seeded Lawn Installation" as applicable.

When the Bid item "Seeded Lawn Installation" is included in the Bid Form, should the Contractor with approval of the Engineer substitute sodding in lieu of seeding for lawn installation, payment will be at the Bid item price Bid for "Seeded Lawn Installation" and no additional or separate payment will be made.

Any incidental Work required to complete the seeded lawn installation or sod installation, as specified herein but not specifically mentioned, shall be incidental to, and all costs therefore shall be included in the Bid item price of the Bid item.

19. **"Lawn Establishment, Minimum Bid (\$ _____)"**, per lump sum.

The Bid item price for "Lawn Establishment, Min. Bid (\$ _____)" shall include all costs for the work required to establish the lawn including all costs to provide and apply water, to mow and to edge. To prevent unbalanced Bids, the Bid item lump sum price Bid for "Lawn Establishment" shall not be less than the Bid item lump sum minimum price noted in the Bid Form. Should the Contractor determine that the cost for this work is greater than the Bid item lump sum minimum price listed in the Bid Form, the Contractor may bid a higher lump sum price by crossing out the Bid item lump sum minimum price and extension shown in the Bid Form, writing in a higher Bid item lump sum price and extension in the Bid Form, and initialing the change. Bids received on this Contract which contain a cost for lawn establishment of less than the Bid item lump sum minimum price shown in the Bid Form will be revised to reflect the Bid item lump sum minimum price allowed including the extension and shall govern as becoming a part of the Bid.

Payment will be made in two payments at the rate of 50% of the Bid item price for "Lawn Establishment, Min. Bid (\$ _____)". The first payment will be processed based on the Contractors statement including a 60-Day schedule for mowing, edging, and other work provided to maintain the lawn as required by the Contract. The second and final payment will be processed at the end of the lawn establishment period based on the Contractors statement including a schedule for mowing, edging, and other work provided to complete the Contract requirements.

20. Other payment information.

When the Bid Form does not include a Bid item for lawn establishment and mowing and edging is required, payment for mowing and edging will be made in accordance with the Bid item "Mowing" in Section 8-01.5. If the Bid Form does not contain either a lawn establishment or a mowing Bid item, payment will be in accordance with Section 1-04.1(2).

Payment for clearing and grubbing will be in accordance with Section 2-01.5

Payment for establishing the subgrade of planting areas prior to actual planting by excavation or embankment construction will be in accordance with Section 2-03.5

Payment for fill Material of the type specified will be in accordance with Section 4-01.5.

Payment for furnishing and placing topsoil will be in accordance with Section 8-01.5.

All costs for fertilizer and other soil amendments specified in the Contract but not set forth in the Bid Form as a separate Bid item shall be included in the Bid item price of the applicable Bid item.

Any incidental work required to complete the roadside planting specified herein, but not specifically mentioned in these Specifications shall be incidental to the roadside planting, and all costs therefore shall be included in the Bid item prices of the Bid items.

SECTION 8-03 IRRIGATION SYSTEM

8-03.1 DESCRIPTION

Section 8-03 describes work consisting of furnishing and installing a complete and functional sprinkler irrigation system in accordance with the Contract.

The Contractor or Subcontractor shall be a Washington State licensed irrigation contractor. The irrigation system shall be installed by a journeyman irrigation mechanic or journeyman plumber and shall be installed according to the local plumbing codes. A plumbing permit will not be required for irrigation work in the Street Right of Way. At least 3 Working Days before backfilling, the Contractor shall provide notice to the Engineer for Seattle Public Utilities' Customer Service Division to inspect and approve the piping and back flow prevention devices.

Electrical Work shall be performed by a licensed electrical contractor. Required permits for electrical work other than irrigation, and other than Street lighting and signals, shall be obtained in accordance with Section 1-07.6. The Contractor shall obtain a class 2 electrical permit from the Seattle Department of Construction and Land Use, when required in the Contract. The Contractor shall become thoroughly familiar with the electrical environment within the Project Site and with the relevant work.

Excavations over 4 feet deep are subject to the provisions of Section 7-17.3(1)A7a, Trench Safety Systems.

8-03.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Geotextile	9-05.22
Irrigation System Materials	9-15
Backflow Prevention Devices	9-30.16
Electrical Conduit	9-34.3

8-03.2(1) APPLICABLE ELECTRICAL CODES

See Section 8-30.1(2).

8-03.3 CONSTRUCTION REQUIREMENTS

8-03.3(1) GENERAL

The Contractor shall check and verify all pertinent dimensions at the Project Site before proceeding with the Work. Before installing the irrigation system, the Contractor shall carefully note all finish grades. Finish grades changed in the course of the Work shall be restored so that the terrain conforms to the finished grade.

The Contractor shall furnish the necessary Equipment for proper execution and completion of all irrigation Work and shall make the connections to the water and electrical services. *After payment for the new service has been received, Seattle Public Utilities' Water Operations will furnish and install the water service, water meter and meter box.* The Contractor shall be responsible to request service coordination with the Engineer and shall allow 8 weeks for installation by Seattle Public Utilities' Water Operations.

After installation of the water service and meter, an acceptable backflow prevention device (BPD) between the water meter and the irrigation system shall be installed and tested. The Contractor shall use only a Washington State Department of Health approved BPD for the intended application. Contact SPU Inspection Services for inspection of the installation after the BPD is installed and tested. All backflow assemblies are required to be tested annually by backflow device testers certified by the Washington State Department of Health. See Sections 9-30.19 and 1-07.28 item 5D.

The Contractor shall provide a minimum 5 Working Days advance notice to the Engineer for inspection and approval of electrical installations before Seattle City Light will make the final service connection to the hot line. Thirty Days advance notice is required for the inspection and service connection by Seattle City Light.

Where indicated on the Drawings, piping and wiring shall be installed within plastic pipe sleeves of sufficient inside diameter to permit easy withdrawal and reinserting of the piping or wire. *Pipe sleeves and piping shall have a minimum of 12 inches soil cover for water pipes, and electrical conduit including conduit sleeves shall have a depth of soil cover of 18 inches or depth of soil cover conforming to the applicable electrical code for electrical wire or conduit with electrical wire, whichever is greater. The detect-a-tape shall be installed 6 inches above the piping or conduit, and 4 inches above the sleeve as indicated on Standard Plan no. 128.*

8-03.3(2) LAYOUT OF IRRIGATION SYSTEM

Before construction begins, the Contractor shall stake the irrigation system layout following the schematic design shown on the Drawings. Alterations of the design and changes in the layout may be expected in order to conform to ground conditions and to obtain full and adequate coverage of sprinkler water. The Contractor shall be responsible for informing the Engineer of any anticipated coverage inadequacies. However, no changes in the system as planned shall be made without the prior authorization of the Engineer.

8-03.3(3) EXCAVATION

All pipe shall be laid in trenches shall be no wider than necessary to lay pipe and install Equipment (see Standard Plan no. 128). *The top 6 inches of topsoil, when such exists, shall be kept separate from other subsoil and shall be used as the topmost 6 inch layer when backfill is made. Trench bottoms shall be relatively smooth and be of suitable Material free from rocks, stones, or other deleterious material which might damage the pipe. All trenches shall be excavated 4 inches below the required depth and backfilled to the required depth with sand or other suitable Material free from rocks or stones as approved by the Engineer.*

If possible, all trenches shall be on a straight line between sprinkler heads or other appurtenances and shall be without abrupt changes in grade.

Care shall be exercised by the Contractor when excavating trenches near existing trees. In addition to the requirements of Section 1-07.16(2), where roots are 2 inches or more in diameter, the pipe trench shall be hand-excavated and tunneled. When 2 inch or larger tree roots are exposed, they shall be wrapped with heavy burlap for protection and be kept moist to prevent drying. No cutting of tree roots larger than 2 inch will be allowed. Where excavating near trees exposes tree roots 2 inches or less in diameter, the Contractor shall clean cut the exposed roots at the trench wall to minimize further damage to the root. In no case shall tree roots be removed by pulling them from the soil. Trenches with exposed tree roots shall be backfilled within 24 hours. Trenches with burlapped roots shall have the burlap removed prior to backfilling.

8-03.3(4) PIPING

All lateral lines and power supply lines shall be a minimum of 18 inches below finished grade measured from the bottom of the pipe, and all mainlines and sleeved pipe shall be a minimum 24 inches below finished grade measured from the bottom of the conduit (see Standard Plan no. 128). All irrigation pipe placed under pavement, without exception, shall be placed in sleeves. Such sleeves shall extend a minimum of 1 foot beyond the limits of pavement. All jacking operations shall be performed in accordance with an approved jacking plan which shall be submitted to the Engineer at least 5 Working Days in advance for review. Where possible, mains and laterals or section piping shall be placed in the same trench and horizontally separated by 6 inches. Bedding Material shall extend from 4 inches below to 6 inches above laterals, mainlines, and sleeves with the exception that power supply lines do not require 4 inch excavation or bedding below the power conduit.

Mainlines and lateral lines shall be defined as follows:

Mainlines: All pressurized supply pipe and fittings between the water meter and the irrigation control valves.
Lateral lines: All supply pipe and fittings between the irrigation control valves and the connections to the irrigation heads. Swing joints, thick-walled pipe, flexible risers, rigid pipe risers, and associated fittings are not considered part of the lateral line but incidental components of the irrigation heads.

Pipe pulling will not be allowed for installation and placement of irrigation pipe.

All sleeves required but not used in this Contract shall be capped and their locations marked with metal stakes and painted blue to provide reference for the as-built Drawings submitted to the Engineer upon completion of the irrigation work (see Section 8-03.3(12)).

8-03.3(5) JOINTING

During construction, pipe ends shall be plugged or capped to prevent entry of dirt, rocks, or other debris.

All galvanized steel pipe shall have sound, clean cut, well fitted standard pipe threads. All pipe shall be reamed to the full diameter and have all burrs removed before assembly. Threaded joints shall be constructed using either a nonhardening, nonseizing multipurpose sealant or teflon tape or paste as recommended by the pipe manufacturer. All threaded joints shall be made tight with wrenches without the use of handle extensions. Joints that leak shall be cleaned and remade with new Material. Caulking or thread cement for making joints tight will not be permitted.

PVC pipe, couplings, and fittings shall be installed in accordance with the manufacturer's recommendation. The outside of the PVC pipe shall be chamfered to a minimum of 1/16 inch at approximately 22 degrees. Pipe and fittings shall be joined by solvent welding. Solvents used *shall* penetrate the surface of both pipe and fitting in order to produce complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.

PVC pipe ends shall be cut at 90 degrees to their longitudinal axis and cleaned of all cutting burrs prior to cementing. Use approved reaming tool. Pipe ends shall be wiped clean with a rag and lightly wetted with PVC primer. A light coat of cement shall be applied on the inside of the fitting and a heavier coat on the outside of the pipe. The pipe shall be inserted into the fitting and given a quarter turn to seat the cement. Excess cement shall be wiped from the outside of the pipe. Pipe shall be tested as indicated elsewhere in these *Standard Specifications*. No backfilling will be permitted, other than at the midsection of pipe lengths, leaving joints exposed until the pressure test is completed and approved.

When connecting plastic pipe to metal pipe, install a female-threaded Schedule 80 PVC coupling onto the metal pipe first; then glue the plastic pipe into the other end of the PVC coupling. No PVC pipe may be threaded or connected to a threaded fitting without an adapter.

Due to the nature of PVC pipe and fittings, the Contractor shall exercise care in their handling, loading, unloading and storing to avoid damage. The pipe and fittings shall be stored under cover. Pipe shall be transported on a vehicle bed long enough to support its entire length so as not to subject it to undue bending or concentrated external loads. Pipe that has been dented or damaged shall be set aside until such damage has been cut out and the pipe sections rejoined with a coupling.

Solvent-welded joints shall be given at least 15 minutes set-up time before moving or handling. Pipe shall be partially center-loaded to prevent arching and slipping. No water shall be permitted in pipe until a period of at least 10 hours has elapsed for solvent weld setting and curing.

Backfilling shall be done when pipe is not in an expanded condition due to heat or pressure. Cooling of the pipe can be accomplished by operating the system for a short time before backfilling or by backfilling in the early part of the morning before the heat of the Day.

Before pressure testing, solvent-welded joints shall be given at least 24 hours curing time.

8-03.3(6) INSTALLATION

Final position of planting bed sprinkler heads shall be as shown in Standard Plan nos. 121 and 126 unless specified otherwise in this Section, with depth of planting mulch adjusted to expose heads in planting beds. Final position of turf sprinkler heads shall be flush with finish grade. All sprinklers adjacent to walks, curbs, and pavement shall be placed 6 inches clear of the edge unless otherwise indicated in Contract.

Shrub sprinkler heads shall be placed on permanent risers approximately 12 inches above finished grade, except pop-up risers shall be used when located adjacent to walks or driveways. All risers shall have approved flexible swing joints.

Final position of valve boxes, capped sleeves, and quick coupler valves in planting beds shall be between 1/2 and 1 inch above finished grade or mulch. Final position of valve boxes shall be flush with finish grade. The geotextile placed under the Mineral Aggregate Type 4 for the quick coupler valve as indicated on Standard Plan no. 121 shall be a nonwoven low survivability underground drainage geotextile as specified in Section 9-05.22.

Drip irrigation emitters shall be installed in accordance with the manufacturer's recommendations.

The irrigation *Drawings* are diagrammatic and are not intended to show exact locations of existing or proposed pipe valves or controllers. New items shall be located in landscaped areas as closely as possible to adjacent curbs or paving.

8-03.3(7) ELECTRICAL WIRE AND CONTROLLER INSTALLATION

Wiring between the automatic controller and automatic valves can share a common neutral. Separate control conductors shall be run from the automatic controller to each valve. A white colored wire shall be used for the neutral as specified in the National Electrical Code. Wires shall be taped together with electrical tape at 5-foot intervals and attached to the irrigation mains by at least 3 wraps of electrical tape at 10-foot intervals.

Wire shall be common to each valve in the system. A loop shall be provided at each valve in any wire that passes or terminates at that valve. Loop knot end of spare wire at valves where wire dead-ends.

Splice insulation shall consist of electrical conductors twisted and bonded by approved pressure connectors and contained in a rigid plastic epoxy-filled mold. Splices will be permitted only at junction boxes, valve boxes, pole bases or control cabinets. An additional 2-foot minimum length of conductor shall be left at each junction box and automatic control valve to facilitate splicing and inspection.

Electrical service shall be provided at controller enclosures as shown on the Drawings.

A diagram of the wiring schedule shall be pasted in the controller cabinet to facilitate the selection of valves to be operated.

The minimum size of wire shall be determined strictly by the following chart:

No. of Valves	Maximum Length of Common Wire			
	500 ft.	1000 ft.	2000 ft.	3000 ft.
1	14	14	14	14
2	14	14	14	10
3	14	14	10	8
4	14	14	10	8
5	14	10	8	6
6	14	10	6	6
7	14	8	6	4
8	14	8	6	4
9	14	8	4	4
10	10	6	4	2
11	10	6	4	---

NOTE – wire sizes in above table are AWG.

The control wires shall be color-coded as follows:

Neutral or common wire	White
Lead-in wire	Black
Extra wire	Orange

Automatic irrigation installations include an automatic controller inside a weatherproof and tamperproof metal housing as described in Section 9-15.4. See Section 8-03.1 electrical contractor qualification requirements. When the Contractor is required to provide power supply to the controller as indicated in the Contract, all electric work shall be installed by an electrician licensed in the State of Washington.

Completion of irrigation work may require inspection and approval of the electrical system by DCLU. It is the Contractor's responsibility to arrange for this inspection.

8-03.3(8) BACKFLOW PREVENTION DEVICE (BPD)

Backflow prevention devices meeting the requirements specified in Section 9-30.16 shall be furnished and installed in an approved vault as indicated on Standard Plan no. 125 and installation shall be verified acceptable by the Engineer. The Contractor shall notify the Engineer at least 3 Working Days in advance to have SPU Customer Service perform the inspection. All backflow prevention devices shall be provided acceptable drainage outlets and shall not be submerged in water. Any drainage problems encountered at the time of system layout or installation shall be immediately brought to the attention of the Engineer. The double check valve backflow prevention device is the only BPD which will be allowed installed below ground surface.

8-03.3(9) FLUSHING AND TESTING

After BPD installation and approval of the Engineer, all flushing and pressure-testing shall be completed before backfilling irrigation system trenches.

The Contractor shall notify the Engineer at least 24 hours before conducting pressure tests.

All gauges used in the testing of water pressures shall be certified calibrated within the last 6 months by an independent ASTM, or other acceptable reference standards organization, accredited testing laboratory for use on the Project.

Automatic controllers shall be tested for a consecutive two week period under normal operating conditions. Should adjustments be required, the Contractor shall carry them out according to the manufacturer's directions and continue tests until operation is acceptable.

Flushing shall be accomplished as follows:

Main Line Flushing: All main supply lines shall receive two fully-open flushings to remove debris that may have entered the line during construction: the first one before placement of valves; the second one after placement of valves and prior to testing.

Main Line Testing: All main supply lines shall be purged of air and tested with a minimum static water pressure of 150 psi for 60 minutes without introduction of additional service or pumping pressure. Testing shall be done with one pressure gauge installed on the line at a location specified by the Engineer. The Contractor shall be prepared to install an additional pressure gauge when so directed by the Engineer. Lines which show loss of pressure exceeding 5 psi at the ends of test periods indicated in the Contract will be rejected.

The Contractor shall correct rejected installations and shall retest them for acceptance.

Lateral Line Flushing: All lateral lines shall receive one fully-open flushing prior to placement of sprinkler heads, emitters, and drain valves. The flushing shall be of sufficient duration to remove any dirt or debris that may have entered the lateral lines during construction.

Lateral Line Testing: All lateral lines shall be purged of air and tested under operating line pressure with risers capped and drain valves closed. The operating line pressure shall be maintained for 30 minutes through open valves and pressure regulating devices. Lines which show leaks at the end of the specified test periods shall be rejected.

When conditions exist which prevent effective visual inspection of lateral lines, the Engineer may require that the lines be tested by use of pressure gauges. In that event, static water pressure, equal to operating line pressure, shall be maintained in the lines for 30 minutes with valves closed and without introduction of additional service pressure. Lateral lines which show loss of pressure exceeding 5 psi at the end of specified test periods will be rejected.

The Contractor shall correct and retest lateral line installations that have been determined unacceptable.

Throughout the life of the Contract, the Contractor shall repair, flush, and test, all main and lateral lines that have sustained a break or disruption of service. Upon restoration of the water service, the affected lines shall be brought up to operating pressure. The Contractor shall then conduct a thorough inspection of all sprinkler heads, emitters, etc., located downstream of the break, disruption of service, and repair. This inspection is required to ensure that the entire irrigation system is operating properly. *A minimum 2 Working Days advance notice to the Engineer is required.*

8-03.3(10) ADJUSTING SYSTEM

Before system operation inspection per Section 8-03.3(13), the Contractor shall adjust and balance all sprinklers to provide adequate and uniform coverage. Spray patterns shall be balanced and fogging minimized by adjusting individual sprinkler heads with the adjustment screws or replacing nozzles to produce a uniform pattern. Sprinkler spray on pavement, walks, or Structures will not be permitted. The Contractor shall provide the Engineer at least 2 Working Days advance notice for this inspection. See Section 1-05.11(3) for general requirements regarding operational testing.

Inadequacies not rectified by adjusting or replacing nozzles shall be corrected by the Contractor to an acceptable condition at the Contractor's sole expense.

8-03.3(11) BACKFILL

The Contractor may begin backfilling (except at joints, fittings, risers and valves) as soon as the section of piping and wiring has been inspected and approved by the Engineer. Once the system has been tested against leaks, and the "as built" location of the risers, fittings, and valves have been recorded by the Engineer, the remaining trench openings may be backfilled. All backfill Material placed within 6 inches of the pipe shall be sand or selected Material approved by the Engineer. Backfilling from the bottom of the trench to approximately 6 inches above the pipe shall be done by continuous compacting in a manner that does not damage pipe or wiring and shall proceed evenly on both sides of the pipe. The remainder of the backfill shall be thoroughly compacted, except that heavy Equipment shall not be used within 18 inches of any pipe. *The top 6 inches of backfill shall consist of either topsoil or the upper 6 inches of excavated Material if found suitable by the Engineer.*

Detectable marking tape shall be placed in the trench 6 inches directly above, parallel to, and along the entire length of all nonmetallic water pipes and all nonmetallic and aluminum conduits placed under existing or future pavement. The width of the tape shall be as recommended by the manufacture for the maximum burial depth to be encountered on the Project.

The Contractor shall give 24-hour notice to the Engineer each time an inspection or a check on system location is required. If any part of the sprinkler system is backfilled before being approved for correct location or before full inspection or testing have been carried out, the trench shall be re-excavated, the system uncovered and left exposed until it is approved for backfilling by the Engineer.

Restoration of ground surface shall include the resetting of removed sod. Sod survival shall be the responsibility of the Contractor.

8-03.3(12) AS-BUILT DRAWINGS AND SYSTEM ORIENTATION

Upon physical completion of the irrigation work including flushing and testing, and at least 5 Working Days before the training and orientation session, the Contractor shall submit preliminary as-built drawings, schematic circuit diagrams, or other drawings as necessary so that the Engineer can prepare corrected Drawings to show the irrigation work as constructed. The as-built drawings shall comply with Section 1-05.3(4) and shall be reproducible and on sheets conforming in size to the provisions of Section 1-05.3(2)C.

Before system operation testing (Section 8-03.3(13), the Contractor shall conduct a training and orientation session covering the operation, adjustment, and maintenance of the irrigation system. The preliminary as-built drawings shall be reviewed and all features explained. At this session, the Contractor shall provide the Engineer with an Operations and Maintenance Manual. The Contractor shall provide Written Notice to the Engineer at least two weeks prior to the training and orientation session. The date and time of the training session shall be subject to approval of the Engineer.

The Operations and Maintenance Manual shall include the following:

1. Catalogues of Materials used;
2. Parts lists;
3. Summary of all operations (spring start-up and winterization techniques, controller programming, valve cleaning, sprinkler adjustment, backflow prevention, etc.); and
4. Names and addresses of local distributors.

Upon system operation and approval of all tests, acceptance of the system will be contingent upon the Contractor providing:

- a. *Signed and approved sprinkler, plumbing, electrical and health department permits;*
- b. *Reproducible final as-built drawings and all catalogue cuts, manufacturer's instructions and maintenance and operating information;*
- c. *All necessary keys and tools to activate, operate and drain the system; and*
- d. *Provide all needed instructions to insure that it continues to operate normally after departure of the Contractor.*

8-03.3(13) SYSTEM OPERATION INSPECTION

After the training and orientation session per Section 8-03.3(12), the irrigation system shall be completely tested and fully operable in the automatic mode prior to planting in the sprinkled area except where otherwise specified in Contract. The Contractor shall, in the presence of the Engineer, do a water coverage test for each sprinkler zone in the system. The Contractor shall change nozzles and make all necessary adjustments to obtain full coverage with minimum overspray. All balancing and adjusting of the system shall have been completed before requesting system operation testing. The Contractor shall be fully responsible for all maintenance, repairs, tests, inspections, and the automatic operation of the system until Work is considered complete as determined by the final inspection specified in Section 1-05.11. The Contractor's responsibility also includes draining the system before winter and reactivating it in the spring and at other times when ordered by the Engineer. This responsibility continues through the landscape establishment period if a landscape establishment Bid item is included in the Bid Form. Irrigation system maintenance shall include restoration of the ground surface to compensate for settling of trenches.

For the life of the Contract, the Contractor shall be responsible for having annual inspections and tests performed on all cross connection control devices as required and specified by the Washington State Department of Health.

Adjustments made in the irrigation system during the system operational testing shall be shown on the final as-built record set of drawings and shall be submitted to the Engineer for approval no later than 5 Working Days after the date of system operation testing accepted by the Engineer.

8-03.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

8-03.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-03 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Irrigation System, Automatic"**, per lump sum.

The Bid item price for "Irrigation System, Automatic" shall include all costs for the work required to furnish, install, and test a complete working system including, but not limited to, excavation, backfill, controller, vaults, valves, valve boxes, conduit, wiring, quick couplers, risers, sprinkler heads and piping. If a hose bib assembly is included in the Contract with an irrigation system and no "Hose Bib Assembly" Bid item is in the Bid Form, payment for the hose bib assembly shall be considered included in the Bid item price for the Bid item "Irrigation System, Automatic".

2. **"Irrigation System, Manual"**, per lump sum.

The Bid item price for "Irrigation System, Manual" shall include all costs for the work required to furnish, install and test a complete working system including, but not limited to, excavation, backfill, valves, valve boxes, vaults, quick couplers, risers, sprinkler heads and piping.

3. **"Hose Bib Assembly"**, per each.

The Bid item price for "Hose Bib Assembly" shall include all costs for the work required to furnish and install the type and size of hose bib assembly specified when not installed as a component of an automatic irrigation system.

4. **"Sleeve, (Material), (Schedule), (Size)"**, per linear foot.

The Bid item price for "Sleeve, (Material), (Schedule), (Size)" shall include all costs for the work required to furnish and install the sleeve of the type and size specified.

5. **"Valve Box, Plastic"**, per each.

The Bid item price for "Valve Box, Plastic" shall include all costs for the work required to furnish and install the valve box of the type specified when "Irrigation System, Manual" and "Irrigation System, Automatic" is not in the Bid Form.

6. **Other payment information.**

All costs of annual inspections and tests performed on cross connection control devices during the life of the Contract shall be included in the Bid item prices for the complete irrigation system.

All costs associated with furnishing and installing the service tap, water meter and meter box will be at Owner expense.

SECTION 8-04 CEMENT CONCRETE CURB, CURB AND GUTTER**8-04.1 DESCRIPTION**

This Work shall consist of constructing cement concrete curb, and curb and gutter.

8-04.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Portland Cement	9-01
Concrete Aggregate	9-03
Premolded Joint Filler	9-04.1
Reinforcing Steel	9-07
Curing Compounds	9-23

The Portland cement concrete shall meet the requirements of Section 5-05. Concrete mix for curb and gutter Type 410B shall be Class 5 (1-1/2), and for curb Type 410C shall be Class 5 (3/4). Slump of the concrete mix shall not exceed 3-1/2 inches.

Epoxy grout for curb dowel anchored in concrete shall be ASTM C 881, Type 1 epoxy grout.

Dowels and reinforcing steel shall be #3 deformed steel billet bars, ASTM A 615, Grade 60.

Forms may be of wood or metal or any other material at the option of the Contractor, provided that the forms as set result in a curb, or curb and gutter of the specified thickness, cross section, grade and alignment shown on the Drawings.

8-04.3 CONSTRUCTION REQUIREMENTS

8-04.3(1) GENERAL

Excavation work to install forms for concrete curb and gutters within the dripline of trees shall be accomplished by hand methods. Where curb or curb and gutter construction is in an area with exposed tree roots 2 inch or greater in diameter, the Contractor shall work with the Engineer as indicated in Section 1-07.16(2).

The Subgrade shall be prepared in accordance with Section 2-06 and properly compacted to the specified grade and width. The compacted Subgrade shall extend at least one foot beyond each edge of the curb and gutter sections to provide a solid base for erecting forms.

Curb associated with monolithic curb and sidewalk shall comply with the requirements of Section 8-14.

The opening of new pavement placed with new curb shall comply with the requirements of Section 5-05.3(17).

8-04.3(1)A ERECTING FORMS

Before erecting forms, the Contractor shall bring the Subgrade to the required line, grade and compaction. Curbs shall not be set until the Subgrade has been compacted to within one inch of established grade.

Forms, wood or steel, shall be staked securely in place, true to line and grade.

Sufficient support shall be given to the form to prevent movement. Forms shall be clean and well oiled prior to setting in place. When set, the top of the form shall not depart from grade more than 1/8 inch when checked with a 10-foot straightedge. The alignment shall not vary more than 1/8 inch in 10 feet. Immediately prior to placing the concrete, forms shall be carefully inspected for proper grading, alignment and rigid construction. Adjustments and repairs as needed shall be completed before placing concrete.

8-04.3(1)B PLACING CONCRETE

The Subgrade shall be properly compacted and brought to specified grade before placing concrete. The Subgrade shall be thoroughly dampened immediately prior to the placement of concrete. Concrete shall be placed and consolidated into the forms to provide a dense, compacted concrete free of rock pockets. The exposed surfaces shall be floated, finished, and brushed longitudinally with a fiber hair brush approved by the Engineer.

The rate of concrete placement shall not exceed the rate at which the various placing and finishing operations can be acceptably performed in accordance with these Specifications.

8-04.3(1)C DOWELS

Dowels shall be placed in the pavement slab as detailed on Standard Plan no. 411.

The dowel bars shall be set while the concrete is still plastic enough to not require hammering them into place.

8-04.3(1)D STRIPPING FORMS AND FINISHING

The face form of the curb shall be stripped early enough in the curing process to permit correction of all irregularities that may appear.

Forms may be removed on the Day following the pour if the concrete has set sufficiently to retain its true shape and removal causes no chipping or spalling. When forms are removed before the expiration of the curing period, the concrete shall be protected and cured. The exposed surface of the curb shall be brushed with a fiber hair brush.

8-04.3(1)E CURING

Transparent curing compound shall be applied to all exposed surfaces immediately after finishing. Transparent curing compounds shall contain a color dye of sufficient strength to render the film distinctly visible on the concrete for a minimum period of 4 hours after application.

If, at any time during the curing period any of the forms are removed, a coat of curing compound shall be applied immediately to the exposed surface. The curing compound shall be applied in sufficient quantity to obscure the natural color of the concrete. Additional coats shall be applied if the Engineer determines that the coverage is not adequate. The concrete shall be cured for the minimum period of time set forth for pavement in Section 5-05.3(13)A.

8-04.3(1)F EXPANSION AND DUMMY JOINTS

Joints shall be constructed in the manner shown on Standard Plan nos. 410 and 411 at locations to match joints in *new concrete pavement, unless otherwise indicated in the Contract*. In no case shall joint spacing exceed 15 feet center to center. All expansion and construction joints shall extend entirely through the curb section. Joint filler in the curb shall be normal to the pavement and in full butt contact with *the* pavement joint. Joints shall match existing transverse joints or cracks in existing pavement.

Locations of joints associated with depressed curbs for curb ramps shall comply with Sections 8-14.3(7) and 8-14.3(8).

8-04.3(1)G FINISHED WORK

When checked with a 10-foot straightedge, grade shall not deviate more than 1/8-inch, and alignment shall not vary more than 1/4 inch.

8-04.3(2) CURB BLOCK-OUTS AT CURB RAMPS

Where new cement concrete curb is to be constructed and a new curb ramp is also to be constructed, the Contractor shall block out the new curb at the locations of the new curb ramps as shown on the Standard Plans unless the Drawings indicate otherwise. New curb ramps shall be constructed monolithic with curb as shown on Standard Plan nos. 422a and 422b.

New curb installation with no sidewalk shall have depressed curb for future curb ramp installation. Typically, curb ramps are paired with each curb ramp on opposite sides of a Traveled Way.

8-04.3(3) RESERVED

8-04.3(4) TYPE 410B CURB AND GUTTER

Curb and gutter shall be constructed as shown on Standard Plan no. 410 on a compacted Subgrade prepared in accordance with applicable Subgrade Specifications for cement concrete pavement in Section 5-05. When extruded curb and gutter is called for, it may be extruded as a unit in accordance with Section 8-06, or the curb may be extruded upon the gutter section in which case steel dowels shall be provided as specified in Section 8-04.3(1)C.

Premolded joint filler shall be as shown on Standard Plan no. 411.

8-04.3(5) TYPE 410C CURB

8-04.3(5)A CEMENT CONCRETE CURB ON EXISTING PAVEMENT

Cement concrete curb constructed on an existing pavement shall be doweled into the existing pavement as shown on Standard Plan nos. 410 and 411 where indicated on the Drawings or designated by the Engineer.

Drilling holes into concrete pavement, or concrete pavement base, for # 3 dowel pins shall comply with the requirements of Section 6-02.3(30). After cleaning the hole of all debris, place #3 dowel pins into the hole and fill with epoxy grout in the manner specified in Section 6-02.3(31). Holes shall be spaced as indicated on the Standard Plans. The distance from the top of the finished curb to the top of the dowel shall be one inch. The epoxy resin system used shall be Type I meeting the requirements of Section 9-26.

Premolded joint filler shall be as shown on Standard Plan no. 411.

8-04.3(5)B CEMENT CONCRETE CURB ON NEW PAVEMENT

Doweled curb on new pavement shall be constructed as shown on Standard Plan nos. 410 and 411.

The pavement width shall extend to the back of the curb. The pavement where the curb is to be placed shall be roughened or otherwise treated so that a permanent bond can be secured between the curb and the pavement. *Curing compound shall not be used on the pavement where curb is to be constructed.*

Dowels, as detailed in Standard Plan nos. 410 and 411 shall be placed at 28 inches on center in the fresh concrete pavement.

Premolded joint filler shall be as shown on Standard Plan no. 411.

8-04.3(6) MOUNTABLE CURB

Mountable curb for traffic circles shall be constructed with the alignment and configuration as shown on Standard Plan no. 415.

The extended depth Portland cement mountable curb to be installed adjacent to asphalt pavement shall have the same dimensions as other mountable curb detailed on Standard Plan no. 415 except the depth of curb shall be extended an additional 7 inches, or more to match the greater depth of adjacent asphalt pavement.

8-04.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for new curb and gutter, and new curb of the type specified, will be by the linear foot along the front face of the curb for the length constructed, including that portion installed through driveways and curb ramps.

No measurement will be made for curb where new curb ramps or new driveways are "cut in" to areas of existing improvements where adjacent curb is to remain as this curb is monolithic with the curb ramp, driveway, or Alley access (see Section 8-14.4 and Standard Plan nos. 422 and 430).

8-04.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-04 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "Curb, Cement Concrete", per linear foot.
2. "Curb, Cement Concrete, Mountable", per linear foot.

3. **“Curb and Gutter, Cement Concrete”**, per linear foot.

The Bid item price for “Curb, Cement Concrete”, for “Curb, Cement Concrete, Mountable”, and for “Curb and Gutter, Cement Concrete” shall include all costs for the work required to construct the curb or curb and gutter of the size and type specified.

Payment for Type 410C curb does not include the pavement slab upon which it is placed. That portion of the pavement slab underneath Type 410C curb that is new will be paid for as concrete pavement in accordance with Section 5-05.5.

SECTION 8-05 RESERVED

SECTION 8-06 EXTRUDED CURB

8-06.1 DESCRIPTION

This Work shall consist of constructing extruded asphalt concrete and cement concrete curb in accordance with these Specifications at locations shown on the Drawings and to the dimensions shown on Standard Plan no. 412. *Except as noted otherwise in Section 8-06, all requirements for cement concrete curb as specified in Section 8-04 shall apply to extruded cement concrete curb.*

8-06.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Portland Cement	9-01
Asphalt	9-02.1
Aggregates	9-03
Reinforcing Steel, Tie Bars	9-07
Curing Compounds	9-23

Extruded asphalt concrete curb shall consist of a hot mix asphalt concrete Class A or Class B meeting the requirements of Section 5-04.

The concrete mix design for extruded cement concrete curb shall be the following (quantities for 1 cubic yard of mix):

Cement (Type II)	658 pounds
Fine Aggregate	1,800 pounds
Coarse Aggregate	1,260 pounds
Water	245 pounds
Air	5% \pm 1-1/2%

Aggregate for cement concrete shall meet the requirements of Grading for Fine Aggregate as specified in Section 9-03.1(2). *The curing compound shall be Type 1D, Class B as specified in Section 9-23.2. Air-entrained concrete shall be used as specified in Section 9-23.6 except that air content shall range from 3 % minimum through 6 % maximum by volume.*

8-06.3 CONSTRUCTION REQUIREMENTS

8-06.3(1) PREPARATION OF PAVEMENT SURFACE

8-06.3(1)A EXTRUDED ASPHALT CONCRETE CURB

The asphalt pavement shall be dry and cleansed of loose or deleterious material. Immediately after cleaning the pavement surface, a tack coat shall be applied *only* to the area of the pavement *where* the curb is to be placed at the rate of .08 to 0.20 gallons per 15 square feet of curb area contact surface with pavement, depending on the width of curb and age of pavement.

8-06.3(1)B EXTRUDED CEMENT CONCRETE CURB

The pavement shall be dry and cleansed of loose or deleterious Materials prior to curb placement. At the Contractor's option, concrete curbs shall be anchored to the existing pavement either by placing steel dowel bars one foot on each side of every joint or by using an adhesive. *Dowel bars shall meet the dimensions shown on Standard Plan nos. 411 and 412. The adhesive shall meet the requirements of Section 9-26 for Type II epoxy resin.*

8-06.3(2) RESERVED

8-06.3(3) EQUIPMENT FOR LAYING CURB

8-06.3(3)A EXTRUDED ASPHALT CONCRETE CURB

The machine for laying the curb shall be of the self-propelled type, equipped with a Material hopper, distributing screw, and adjustable curb forming devices capable of laying and compacting the hot-mix asphalt concrete to the lines, grades and cross section shown on the Drawings and in accordance with Standard Plan no. 412. Curbs shall be placed in an even homogenous manner, free of honeycombs.

8-06.3(3)B EXTRUDED CEMENT CONCRETE CURB

Extruded cement concrete curb shall be placed, shaped and compacted true to line and grade with an approved extrusion machine. The extrusion machine shall be capable of shaping and thoroughly compacting the concrete to the required cross section.

8-06.3(4) MIXING AND PLACING**8-06.3(4)A EXTRUDED ASPHALT CONCRETE CURB**

The asphalt concrete mixture shall be homogeneously mixed to conform with Section 5-04.3(8) and shall be delivered to the hopper of the laying machine at a temperature no lower than 200 8F nor higher than 300 8F. Each hopper load of the asphalt concrete mix shall be run through the curb laying machine, properly adjusted to form a well compacted asphalt concrete curb.

8-06.3(4)B EXTRUDED CEMENT CONCRETE CURB

The cement concrete mixture shall be homogeneously mixed to conform with Section 5-05.3(5) when delivered to the hopper of the curb machine. Each hopper load of cement concrete shall be run through the curb laying machine, adjusted properly to form and compact the cement mix for the concrete curb.

8-06.3(5) JOINTS**8-06.3(5)A EXTRUDED ASPHALT CONCRETE CURB**

Asphalt concrete curb construction at the specified temperature shall be a continuous operation in one direction so as to eliminate curb joints. However, where conditions are such that this is not possible, the joints between successive Days Work shall be carefully made in such a manner as to ensure a continuous bond between the old and new sections of the curb. The contact surface of the previously constructed curb shall be painted with a thin, uniform coat of tack coat or cutback emulsion immediately prior to placing the fresh asphalt concrete curb against it.

8-06.3(5)B EXTRUDED CEMENT CONCRETE CURB

Joints in the extruded cement concrete curb shall be spaced at 15-foot intervals or shall match existing transverse joints or cracks in existing pavement. Joints shall be cut vertically. Joints shall not be placed at location of curb dowels.

8-06.3(6) CURING EXTRUDED CEMENT CONCRETE CURB

Type 1D, Class B liquid curing compound shall be used. Sufficient pigment shall be present so that the sprayed compound is easily discernible.

8-06.3(7) PROTECTION FROM TRAFFIC

The newly laid extruded asphalt concrete curb shall be protected from *Traffic* by barricades or other suitable means until the heat of the asphalt concrete mixture has been dissipated and the mixture has attained its proper degree of hardness.

The newly placed extruded cement concrete curb shall be protected from *Traffic* by barricades or other suitable means for at least 72 hours when it has attained its required strength of 2500 psi.

See Sections 1-07.23 and 1-10.

8-06.3(8) SUBSTITUTIONS

The Contractor may substitute extruded cement concrete curb for extruded asphalt concrete curb upon submitting to and receiving approval from the Engineer. Asphalt curb shall not be substituted for cement concrete curb.

8-06.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs *herein* this Section.

Extruded concrete curb will be measured by the linear foot along the front face of the curb and returns.

8-06.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-06 will be made at the Bid item price Bid only for the Bid item listed or referenced as follows:

1. **"Extruded Curb, (Material)"**, per linear foot.

The Bid item price for "Extruded Curb, (Material)" shall include all costs for the work required to furnish and install the Material type extruded curb.

2. **Other information.**

Extruded cement concrete curb substituted for extruded asphalt curb as specified in Section 8-06.3(8) shall be at the Contractor's sole expense and at no additional or separate cost to the Owner.

SECTION 8-07 PRECAST TRAFFIC CURB AND BLOCK TRAFFIC CURB**8-07.1 DESCRIPTION**

This Work shall consist of furnishing and installing precast cement concrete traffic curb and concrete block traffic curb of the design and type, and at the locations, specified in the Contract, conforming to these Specifications and to Standard Plan nos. 413 and 414. See Section 8-04.3(6) for traffic circle curb.

8-07.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Concrete Sand	9-03.1(2)
Precast & Block Traffic Curb, Water repellent Compound, Sodium Metasilicate	9-18.1
Paint	9-29

Glass traffic beads shall comply with the requirements of Section 8-22.2.

8-07.3 CONSTRUCTION REQUIREMENTS**8-07.3(1) INSTALLING CURBS**

The curb shall be firmly bedded for its entire length and breadth on a mortar bed composed of one part Portland cement and two parts concrete sand. The anchor grooves in the bottom of the curb shall be completely filled with the mortar.

Before the cement mortar bed is laid, the pavement surface shall be cleaned of all dirt or other deleterious material including but not limited to oil, grease, tar, or other "oily" substance. The pavement surface shall be flushed with water and cleaning agents as necessary using a stiff brush to produce a surface capable of bonding new curb to pavement.

Pavement surfaces covered with oil, grease, tar, or other oily substance shall be cleaned as follows:

1. The pavement shall be flushed with water.
2. While the pavement is still wet, sodium metasilicate shall be evenly distributed over the pavement surface at a rate of 1 to 2 pounds per 100 square feet of pavement surface.
3. The sodium metasilicate shall remain on the pavement for at least 15 minutes. Areas where patches of oil, tar, or grease occur shall be scrubbed with a stiff brush or broom.
4. The pavement surface shall then be thoroughly rinsed.
5. Steps 2 through 4 shall be repeated until a surface is obtained which is acceptable to the Engineer.

All joints between adjacent pieces of curb, except joints for expansion and/or drainage as designated by the Engineer, shall be filled with mortar composed of one part Portland cement and two parts concrete sand.

Joints between adjacent units of block traffic curb shall not be filled with mortar.

The alignment and the top surface of adjoining sections of curb shall be true and even with a maximum tolerance of 1/16 inch.

Nosing pieces, connecting dividers, and radial sections as detailed on the Drawings shall be required at the ends of the curb lines for all types traffic curbs at transitions from Type 413C traffic curb to Type 413A traffic curb, and at Type 413A traffic curb installation with radii less than 10 feet.

8-07.3(2) PAINTING OF CURBS

Concrete traffic curbs shall be painted with 2 full coats of approved traffic paint as specified on the Drawings. The second coat shall have glass traffic paint beads uniformly sprinkled in the wet paint at the rate of 12 pounds per 100 linear feet of curbing. *The glass beads shall be applied as specified in Section 8-22.3(4)A.*

8-07.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for precast traffic curb and block traffic curb will be by the linear foot along the top surface of the curb and return. The nosing pieces and dividers will be measured as traffic curb.

8-07.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-07 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "Curb, Traffic, Precast", per linear foot.
2. "Curb, Traffic, Block", per linear foot.

The Bid item prices for "Curb, Traffic, Precast" and for "Curb, Traffic, Block" shall include all costs for the work required to furnish and install the specified type traffic curb.

3. **Other payment information.**

Payment for painting precast curb will be in accordance with Section 8-22.5.

SECTION 8-08 PLASTIC LANE MARKERS AND TRAFFIC BUTTONS**8-08.1 DESCRIPTION**

This Work shall consist of furnishing and installing plastic lane markers and traffic buttons with an epoxy adhesive in accordance with these Specifications and Standard Plan nos. 700 and 710.

Color of Type 1, Type 2A, and Type 2B lane markers and traffic buttons shall match the color of the pavement markings on which they are installed. The color of applicable pavement markings are set forth in Section 8-22.

8-08.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Lane Markers Type 1 & Type 2, and Plastic Traffic Buttons	9-21
Adhesive	9-26

8-08.3 CONSTRUCTION REQUIREMENTS**8-08.3(1) GENERAL**

Location and spacing shall be as indicated on the Drawings or designated by the Engineer. The Engineer will provide necessary control points. The Contractor shall be responsible for preliminary spotting of plastic buttons and lane markers from the control points prior to installation. Approval by the Engineer of the layout shall be obtained before traffic button or markers are installed.

8-08.3(2) SURFACE PREPARATION

Traffic buttons and lane markers shall be bonded to clean and dry pavement with an adhesive as specified herein.

All sand, dirt and loose extraneous Material shall be removed from the marker lane location.

Large areas of tar, grease or foreign Materials may require sand blasting, steam cleaning or power brooming to accomplish complete removal. Application of traffic buttons and lane markers shall not proceed until the cleaned surface has been approved by the Engineer.

8-08.3(3) ADHESIVE PREPARATION

At the time of use, the contents of Packages A and B specified in Section 9-26 shall be thoroughly blended by mixing to produce a uniformly distributed mixture. One volume or weight of Package A shall be mixed with one volume or weight of Package B until a uniform gray color is achieved without visible streaks of white or black. Formulation may be revised, if approved by the Engineer.

Catalyst shall be added to the base just before use. Unused mixed adhesive shall be discarded when catalytic action has caused stiffening and reduction of workability or a small ball of jelled resin has formed in the center of the container.

The adhesive shall be maintained at a temperature between 60 and 85 °F before use and during application.

8-08.3(4) APPLICATION PROCEDURE

Applications of traffic buttons and lane markers to pavement shall not be done if the ambient air temperature is below 40°F or if the pavement is moist.

The mixed adhesive shall be applied to the base of the traffic button and lane marker with a quantity sufficient to overfill all voids between the base of the traffic button or lane marker and the pavement, such that as the traffic button and marker is worked into final position, the excess adhesive is forced out to form a bead rim around the entire perimeter of the traffic button or lane marker.

Traffic buttons and lane markers shall be spaced and aligned as indicated on Standard Plan no. 710 unless otherwise indicated on the Drawings or designated by the Engineer. A displacement of not more than 1/2 inch left or right of the established guide line will be permitted. Improperly placed buttons shall be removed and replaced at the Contractor's expense.

Bonding shall be considered *acceptable* when adhesive develops a minimum bond strength in tension of not less than 10 pounds per square inch for plastic traffic buttons, and not less than 2 pounds per square inch for lane markers Type 1, Type 2A and Type 2B. *Traffic shall be prevented from disturbing traffic buttons and lane markers until the minimum bonding strength has been achieved.*

Where it is required that both paint striping and Lane Marker Type 1 are to be installed on the same alignment, the Contractor shall install the lane markers prior to the application of the paint striping.

At the option of the Contractor, a hot melt bitumen adhesive may be used to cement markers to the pavement in lieu of epoxy adhesive. The bitumen adhesive shall conform to the requirements of Section 9-02.1(8).

Markers shall not be placed using bitumen adhesive when the pavement or air temperature is 50 °F or cooler.

Bitumen adhesive shall be indirectly heated in an applicator with continuous agitation. The adhesive shall be applied at a temperature between 400 °F and 425 °F. Markers shall be placed immediately after application of the adhesive.

Lane markers shall not be placed over any pavement joint.

8-08.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

8-08.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-08 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows.

1. "Lane Marker, (Type)", per each.
2. "Plastic Traffic Button, (Type)", per each.

The Bid item prices for "Lane Marker, (Type)" and for "Plastic Traffic Button, (Type)" shall include all costs for the work required to furnish and install the specified type traffic buttons and lane markers.

SECTION 8-09 RESERVED

SECTION 8-10 FLEXIBLE DELINEATOR POSTS**8-10.1 DESCRIPTION**

This Work shall consist of furnishing and placing flexible delineator posts of the type specified on the Drawings in accordance with these Specifications and at the locations indicated on the Drawings or where designated by the Engineer.

8-10.2 MATERIALS

Flexible delineator posts and reflective sheeting shall be made of approved Materials and shall be purchased from manufacturers listed in the Contract.

All posts shall be a minimum length of 72 inches. Posts shall be painted white or brown as called for on the Drawings.

All flexible delineator posts shall have a permanent mark identifying the manufacturer's recommended burial depth.

8-10.3 CONSTRUCTION REQUIREMENTS

Flexible delineator posts shall be installed plumb and in accordance with the manufacturer's recommendations. The Contractor shall submit to the Engineer, the manufacturer's recommended installation procedure at least 5 working Days prior to installation. Only one type of flexible delineator post shall be used on each Project.

If the ground adjacent to the posts is disturbed in any manner, it shall be backfilled to the level of the pre-existing surface and thoroughly compacted. When applicable, the new surfacing on the ground adjacent to the post shall be restored with in kind Material matching the pre-existing material.

8-10.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Flexible delineator posts will be measured by each post furnished and installed.

8-10.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-10 will be made at the Bid item price Bid only for the Bid item listed or referenced as follows:

1. **"Flexible Delineator Post"**, per each.

The Bid item price for "Flexible Delineator Post" shall include all costs for the work required to furnish and install the delineator post of the type specified, including reflectorizing and any excavating and backfilling that may be required.

SECTION 8-11 GUARDRAIL**8-11.1 DESCRIPTION**

Section 8-11 describes the work consisting of constructing, modifying, removing and resetting guardrail and anchors of the kind and type specified in the Contract and in the WSDOT C-Series Standard Plans, in conformity with the lines and grades indicated on the Drawings.

8-11.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Guardrail Elements, Posts, Blocks, Hardware, and Anchors	9-16
--	------

8-11.3 CONSTRUCTION REQUIREMENTS**8-11.3(1) BEAM GUARDRAIL****8-11.3(1)A ERECTION OF POSTS**

The posts shall be set plumb and to the true line and grade of the roadway with spacing as indicated on the Drawings. When the Drawings require that the ends of a section of guardrail be curved outward or downward, the end posts shall be set to accommodate the curve. End treatment shall be in accordance with the appropriate WSDOT Standard Plans unless the Contract indicates otherwise.

The dimensions of posts to be installed shall be as shown in the WSDOT C-Series Standard Plans unless a detailed modified design is approved by the Engineer. The length of posts for beam guardrail Type 1 with long posts shall be as specified on the Drawings.

Posts may be placed in dug or drilled holes. Ramming or driving the post will be permitted only if approved by the Engineer and if no damage to the pavement, shoulders, adjacent slopes, and the post results therefrom.

In broken rock embankments, the pre-punching of holes will be permitted only prior to final Shoulder or median compaction, surfacing, and paving.

The posts shall be protected from Traffic at all times by attaching the rail elements or by a method approved by the Engineer.

8-11.3(1)B RESERVED

8-11.3(1)C ERECTION OF RAIL

All metal work shall be fabricated in the shop. No punching, cutting, or welding shall be done in the field, except that holes for special details in exceptional cases may be drilled in the field when approved by the Engineer. The rail shall be erected so that the bolts at expansion joints are located at the centers of the slotted holes.

Rail plates shall be assembled with the splice joints lapping in the direction of the Traffic.

Galvanized rail plates shall be fastened to the posts with galvanized bolts, washers, and nuts of the size and kind shown on the Drawings. Weathering steel rail plates shall be fastened to the posts with weathering steel bolts, washers, and nuts of the size and kind showing on the Drawings and shall not be galvanized.

All bolts, except where otherwise required at expansion joints, shall be drawn tight. Bolts through expansion joints shall be drawn up as tight as possible without being tight enough to prevent the rail elements from sliding past one another longitudinally. Bolts shall be sufficiently long to extend at least 1/4-inch beyond the nuts. Except where required for adjustments, bolts shall not extend more than 1/2-inch beyond the nuts.

After completing the installation of weathering steel beam guardrail, the Contractor shall wash the rail with clean water under high pressure. If the rail is contaminated by oil or grease, sandblasting shall be used as necessary to clean the rail.

8-11.3(1)D ANCHOR INSTALLATION

All excavation and backfilling required for installation of anchors shall be performed in accordance with Section 2-09.

Bolts shall be tightened to the tension specified. The anchor cable shall be tightened sufficiently to eliminate all slack.

Where additional posts are required, field drilling of the rail will be permitted when approved by the Engineer.

Type 2 concrete anchors may either be pre-cast or cast-in-place at the option of the Contractor.

8-11.3(1)E GUARDRAIL SHOP DRAWINGS

At least 5 Working Days in advance, the Contractor shall submit to the Engineer, additional detailed Shop Drawings of rail punchings, fittings, and assemblies to verify integrity and constructability.

8-11.3(2) GUARDRAIL CONSTRUCTION EXPOSED TO TRAFFIC

Any section of beam guardrail that is removed for modification shall be put back in place within 5 calendar Days of the date the guardrail was removed.

The Contractor's operations shall be conducted in such a manner that fixed objects including beam guardrail posts shall be protected from Traffic at all times by attachment of the rail elements and all associated hardware or by a method approved by the Engineer.

At the end of each Day, guardrail sections having an exposed end toward oncoming Traffic shall have a Type G terminal end section bolted securely in place.

8-11.3(3) ACCESS CONTROL GATES

Access control gates shall be placed to line and grade as shown on the Drawings or as staked by the Engineer. After the posts have been set, the holes shall be backfilled with suitable Material and the Material thoroughly tamped.

8-11.3(4) RAISING GUARDRAIL

Guardrail shall be raised to the height shown on the Drawings, measured from the top of the rail to the finished Shoulder surface. The Material around each post shall be tamped to prevent settlement of the raised rail.

8-11.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement of beam guardrail and beam guardrail Type 1 long posts will be by the linear foot measured along the line of the completed guardrail, including expansion sections, and will also include the terminal section for Type F connections.

Measurement of beam guardrail transition sections will be per each for the type of transition section installed. Terminal sections, except Type F connections, will be considered part of the transition section and will be included in the measurement of the transition section.

Measurement of beam guardrail anchors of the type specified will be per each for the completed anchors, including their attachment to the guardrail.

Measurement of raising beam guardrail, and removing and resetting beam guardrail will be by the linear foot measured along the line of guardrail actually raised or removed and reset. This includes transition sections, expansion sections, and terminal sections.

8-11.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-11 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "Beam Guardrail, (Type)", per linear foot.
2. "Beam Guardrail, (Type), Long Post", per linear foot.
3. "Weathering Steel Beam Guardrail, (Type)", per linear foot.

The *Bid item prices* for "Beam Guardrail, (Type)", for "Beam Guardrail, (Type), Long Post", and for "Weathering Steel Beam Guardrail, (Type)" shall include all costs for the work required to furnish and install the beam guardrail, including all standard and CRT ("controlled releasing terminal") treated timber posts to which the guardrail is attached.

4. **"Beam Guardrail Anchor, (Type)", per each.**

The Bid item price for "Beam Guardrail Anchor, (Type)" shall include all costs for the work required to furnish and install the specified type anchor, including excavation, backfilling, compaction, disposal of surplus excavated Material, and surface restoration. Where Type 2 anchors are required, the additional depth of post embedment shall be included in the Bid item price of the anchor. 10-inch x 10-inch treated timber posts (or steel alternate) will be paid separately as outlined herein.

5. **"Beam Guardrail Transition Section, (Type)", per each.**

The Bid item price per each for "Beam Guardrail Transition Section, (Type)" shall include all costs for the work required to furnish and install posts, terminal sections, and attaching the transition section to masonry Structures.

6. **"Access Control Gate", per each.**

The Bid item price for "Access Control Gate" shall include all costs for the work required to furnish and install the access control gate as specified, including excavating, backfilling, compacting and surface restoration.

7. **"Removing and Resetting Beam Guardrail", per linear foot.**

The Bid item price for "Removing and Resetting Beam Guardrail" shall include all costs for the work required to remove, relocate, and install the beam guardrail with posts.

8. **"Raising Existing Beam Guardrail", per linear foot.**

The Bid item price per linear foot for "Raising Existing Beam Guardrail" shall include all costs for the work required to remove and reset or raise the guardrail and for backfilling and compacting holes.

SECTION 8-12 CHAIN LINK FENCE AND WIRE FENCE

8-12.1 DESCRIPTION

This Work shall consist of furnishing and constructing chain link fence and wire fence of the types specified in accordance with the Drawings, these Specifications and Standard Plan nos. 450a, b, and c and WSDOT Standard Plan no. L-1, at the locations shown on the Drawings and in conformity with the lines as staked by the Engineer.

8-12.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Concrete Class 5	5-05
Chain Link Fence, Wire Fence, and Gates	9-16

Chain link fence shall be of diamond woven wire mesh mounted on steel posts. *All fence and gate without barbed wire shall have knuckled selvage at the top and bottom edges whether the edges are free, have tension wire, or have a rail. Unless the Contract specifies otherwise, all fence and gate with barbed wire shall have twisted and barbed selvage at the top and bottom edges whether the edges are free, have tension wire, or have a rail.*

Wire fence shall be of barbed wire or barbed wire combined with wire mesh fastened to posts. Steel posts and steel braces, or wood posts and wood braces may be used, provided only one type shall be selected for use in any Contract.

Gates shall consist of a steel frame or frames covered with chain link or wire mesh.

8-12.3 CONSTRUCTION REQUIREMENTS

8-12.3(1) GENERAL

Clearing of the fence line may be required. Clearing shall be in accordance with Section 2-01.3(1).

For chain link type fences, the clearing width shall be approximately 10 feet. For wire type fences, the clearing width shall be approximately 3 feet. Grubbing will not be required except where short and abrupt changes in the ground contour necessitate cuts or fills in order to properly grade the fence line. All stumps within the clearing limits shall be removed or close cut.

Grading of the fence line sufficient to prevent short and abrupt breaks in the ground contour and to improve the aesthetic appearance of the top of the fencing when installed shall be required. It is expected that in the performance of this work, machine operations will be required for chain link fencing, and hand work will be required for wire fencing except where sufficient width exists for machine work.

The fence shall be constructed close to and inside the Right of Way line unless otherwise shown in Contract. Deviations in alignment to miss obstacles will be permitted only when approved by the Engineer and only when such deviation is not visible to the traveling public or adjacent property owners.

8-12.3(2) CHAIN LINK FENCE AND GATES

8-12.3(2)A POSTS

Posts shall be placed in a vertical position and, except where otherwise shown in Contract, shall be spaced at 10-foot centers. Spacing shall be measured parallel to the slope of the ground.

All posts, except line posts for Type 3 fence, shall be set in concrete to the dimensions shown in Standard Plan nos. 450a and 450c. All concrete footings shall be crowned so as to shed water. Line posts on Type 3 fence shall be set in

undisturbed earth either by driving or drilling, except as specified. Driving shall be accomplished in such a manner as not to damage the post. Voids around the post shall be backfilled with suitable Material and thoroughly tamped.

Concrete footings shall be constructed to embed the line posts on Type 3 fence at grade depressions where the Engineer determines tension on the fence may pull the post from the ground.

Where solid rock is encountered without an overburden of soil, line posts shall be into the solid rock set a minimum depth of 14 inches, and end, corner, gate, brace, and pull posts a minimum of 20 inches. The holes shall have a minimum width 1 inch greater than the largest dimension of the post section to be set. The posts shall be cut before installation to lengths which give the required length of post above ground, or if the Contractor so elects, an uncut length of post set at a greater depth into the solid rock.

After the post is set and plumbed, the hole shall be filled with grout consisting of one part Portland cement and three parts clean, well graded sand. The grout shall be thoroughly worked into the hole so as to leave no voids. The grout shall be crowned to carry water from the post.

Where solid rock is covered by an overburden of soil or loose rock, the posts shall be set to the full depth shown in the Standard Plans unless penetration into solid rock reaches the minimum depths specified above, in which case the depth of penetration may be terminated. Concrete footings shall be constructed from the solid rock to the top of the ground. Grouting will be required on the portion of the post in solid rock.

Pull posts, as shown in Standard Plan nos. 450a and 450c, shall be braced to adjacent line posts and spaced at 1000 foot maximum intervals for Type 1, 3 and 6 fence and at 500 foot maximum intervals for Type 4 fence.

End, gate, corner, and pull posts shall be braced to the adjacent brace post(s) in the manner shown in Standard Plan nos. 450a and 450c. Changes in line amounting to 2 foot tangent offset or more between posts shall be considered as corners for all types of fence.

Steep slopes or abrupt topography may require changes in various elements of the fence. It shall be the responsibility of the Contractor to provide all posts of sufficient length to accommodate the chain link fabric and ornamental tops adapted to receive the top rail.

All posts for chain link fence Types 1 and 6 shall be fitted with an approved top designed to fit securely over the post and carry the top rail. All round posts for chain link fence Types 3 and 4 shall have approved tops fastened securely to the posts. The base of the top fitting for round posts shall carry an apron around the outside of the posts.

8-12.3(2)B TOP RAIL

Top rails shall pass through the ornamental tops of the line posts, forming a continuous brace from end to end of each stretch of fence. Lengths of tubular top rail shall be joined by sleeve couplings. Top rails shall be securely fastened to terminal posts by pressed steel fittings or other appropriate means.

8-12.3(2)C TENSION WIRE

One continuous length of tension wire shall be used between pull posts. Sufficient tension shall be applied to avoid excess sag between the posts. Tension wires shall be tied or otherwise fastened to end, gate, corner, or pull posts by methods approved by the Engineer.

8-12.3(2)D CHAIN LINK FABRIC

Chain link fabric on Type 1, 3, 4, and 6 fence shall be placed on the face of the post as indicated on the Drawings.

Chain link fabric on Type 1, 3, 4, and 6 fences shall be placed approximately 1 inch above the ground and on a straight grade between posts by excavating high points of ground. Filling of depressions will be permitted only upon approval of the Engineer.

The fabric shall be stretched taut and securely fastened to the posts. Fastening to end, gate, corner, and pull posts shall be with stretcher bars and fabric bands spaced at intervals of 15 inches or less or by weaving the fabric into the fastening loops of roll-formed posts. Fastening to line posts shall be with tie wire, metal bands, or other approved method attached at 14 inch intervals. The top and bottom edge of the fabric shall be fastened with the wires spaced at 24 inch intervals to the top rail, or top and bottom tension wires as may be applicable.

Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

8-12.3(2)E CHAIN LINK GATES

Chain link fabric shall be fastened to the end bars of the gate frame by stretcher bars and fabric bands and to the top and bottom bars of the gate frames by tie wires in the same manner as specified for the chain link fence fabric, or by other standard methods if approved by the Engineer.

Welded connections on gate frames where the spelter coating has been burned shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked spelter removed. The clean areas shall then be painted with two coats of galvanizing repair paint, Formula A-9-73.

The drop bar locking device for the wire gates shall be provided with a 12 inch round by 18 inch deep footing of Class 5 concrete, crowned at the top and provided with a hole to receive the locking bar. The depth of the penetration of the locking bar into the footing shall be as specified by the manufacturer of the locking device. A lock approved by the Engineer shall be installed on all locking gates. Four keys shall be supplied with each lock.

8-12.3(3) WIRE FENCE AND GATES**8-12.3(3)A POSTS**

Line posts shall be spaced at intervals not to exceed 14 feet. All intervals shall be measured center to center of posts. In general, in determining the spacing of posts, measurements will be made parallel to the slope of the existing ground, and all posts shall be placed in a vertical position except where otherwise *indicated in Contract*.

Line posts may be driven in place provided the method of driving does not damage the post. Steel corner, gate, and pull posts shall be set in *Class 5 concrete footings to the dimensions shown in WSDOT Standard Plan no. L-1 and crowned at the top to shed water.*

Class 5 concrete footings shall be constructed to embed the lower part of steel line posts, and wood anchors shall be placed on wood posts at grade depressions wherever the Engineer determines tension on the line wires tend to pull the post from the ground. The concrete footings shall be 3 feet deep by 12 inches in diameter and crowned at the top.

Where solid rock is encountered without an overburden of soil, line posts shall be set into the solid rock a minimum depth of 14 inches, and end, corner, gate, and pull posts a minimum depth of 20 inches into the solid rock. The hole shall have a minimum dimension 1 inch greater than the largest dimension of the post section to be set. The posts shall be cut before installation to lengths which give 4-1/2 feet of post above ground, or if the Contractor so elects, 6 foot posts set 18 inches into the solid rock may be used.

After the post is set and plumbed, the hole shall be filled with grout consisting of one part Portland cement and three parts clean, well graded sand. The grout shall be thoroughly worked into the hole so as to leave no voids. The grout shall be crowned to carry water away from the post. Where posts are set in the above manner, anchor plates and concrete footings will not be required.

Where solid rock is covered by an overburden of soil or loose rock, the posts shall be set to the full depth of 2-1/2 feet unless the penetration into solid rock reaches the minimum depths specified above, in which case the depth of penetration may be terminated. When the depth of the overburden is greater than 12 inches, anchor plates will be required on the steel line posts, and concrete footings shall be constructed from the solid rock to the top of the ground on steel end, gate, corner, and pull posts. When the depth of overburden is 12 inches or less, anchor plates and concrete footings will not be required. Grouting will be required on the portion of the post in solid rock.

Steel braces shall be anchored to soil or loose rock with a *Class 5 concrete footing not less than 18 inches on any one side and set in solid rock to a minimum depth of 10 inches in the same manner as specified above for posts. The braces shall be set on the diagonal as shown on Standard Plan nos. 450a and 450c and connected to the post with an approved connection.*

Wood braces shall be dapped 1/4-inch into the posts and shall be fastened to each post with three 20d galvanized nails.

Wire braces shall consist of a 9 gage wire passed around the wood posts to form a double wire. The wire shall be fastened to each post with two staples and fastened together to form a continuous wire. The wires shall then be twisted together until the wire is in tension.

Where the new fence joins an existing fence, the two shall be attached in an acceptable manner, end or corner posts being set as necessary.

Pull posts shall be spaced not more than 1000 feet apart, but spacing shall be such as to use standard rolls of wire mesh with a minimum of cutting and Waste.

Changes in alignment of 30 degrees or more shall be considered as corners, and corner posts shall be installed. Where it is deemed by the Engineer that a change in alignment of less than 30 degrees materially lessen the strength of the fence, the line post at the angle shall be supported by the addition of braces or wires in an *acceptable* manner.

8-12.3(3)B BARBED WIRE AND WIRE MESH

After the pull posts have been placed and securely braced, the barbed wire and mesh shall be pulled taut to a no slack condition, and each longitudinal wire shall be cut and securely fastened to the pull post with devices customarily used for the purpose. Wire or mesh shall not be carried past a pull post, but shall be cut and fastened to the pull post independently for the adjacent spans.

After the tensioning of the wire or mesh between two pull posts, all longitudinal wires shall be properly fastened at proper height to each intervening line post.

Wire mesh and barbed wire shall be placed on the face of the post which is away from the Highway, except that on horizontal curves, the mesh and wires shall be fastened to the face on the outside of the curve.

Where unusual ground depressions occur between posts, the fence shall be guyed to the ground by means of a 9 gage galvanized wire attached to a deadperson of approximately 100 pounds buried 2 feet in the ground. The guy wire shall be securely attached to each strand of barbed wire and to the top and bottom wires of the wire mesh fabric in a manner to maintain the entire fence in its normal shape. If necessary to guy the fence in solid rock, the guy wire shall be anchored in a grouted hole 2 inches in a diameter and 10 inches deep. The operation of guying shall leave the fence snug with the ground.

8-12.3(3)C VERTICAL CINCH STAYS

Vertical cinch stays shall be installed midway between posts on both types of fence. The wire shall be twisted in such a manner as to permit weaving into the horizontal fence wires to provide rigid spacing. All barbed wires and the top, middle, and bottom wire of the wire mesh shall be woven into the stay.

8-12.3(3)D WIRE GATES

The wire mesh fabric shall be taut and securely tied to the frame and stays in accordance with recognized standard practice for wire gate construction.

Welded connections on gate frames shall be treated as specified for chain link fence gates.

The drop bar locking device for double wire gates shall be provided with a footing of Class 5 concrete 12 inches in diameter and 12 inches deep, crowned on top and provided with a hole to receive the locking bar. The diameter and depth of the hole in the footing shall be as specified by the manufacturer of the locking device.

8-12.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Chain link fence, and wire fence, will be measured by the linear foot of completed fence, along the ground line, exclusive of openings.

8-12.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-12 will be made only at the Bid item prices Bid for the Bid items listed or referenced as follows:

1. "Chain Link Fence, (Type)", per linear foot.
2. "Wire Fence (Type)", per linear foot.

The Bid item prices for "Chain Link Fence, (Type)" and for "Wire Fence, (Type)" shall include all costs for the work required to furnish and install a complete fence including posts, fabric, tension wire, concrete footings, excavation, backfill and compaction, and all incidentals.

3. "Chain Link Gate, Single 6 Ft. Wide", per each.
4. "Chain Link Gate, Double 14 Ft. Wide", per each.
5. "Chain Link Gate, Double 20 Ft. Wide", per each.
6. "Wire Gate, Single, 14 Ft. Wide", per each.
7. "Wire Gate, Double, 20 Ft. Wide", per each.

The Bid item prices for chain link gate and wire gate of the size and type specified shall include all costs for the work required to furnish and install a complete gate including posts, fabric, concrete footings, excavation, backfill and compaction, and all incidentals including locks and keys.

8. Other payment information.

When there is no "Clearing", "Grubbing", or "Clearing and Grubbing" Bid item included in the Bid Form, all costs for the required clearing and grubbing shall be included in the applicable fence and gate Bid item price.

SECTION 8-13 MONUMENT CASES**8-13.1 DESCRIPTION**

This Work consists of furnishing and setting survey monument frame and cover castings, and removing and resetting monument castings which may be covered over, damaged, or otherwise rendered useless due to construction activities.

8-13.2 MATERIALS

Materials shall meet the requirements of the following Section:

Monument Frame and Covers	9-22
---------------------------	------

8-13.3 CONSTRUCTION REQUIREMENTS**8-13.3(1) REFERENCE POINTS – GENERAL**

The Engineer will reference all monuments in advance of construction, and will tie out and reset the points and grades in coordination with Contractor activities.

It shall be the responsibility of the Contractor to furnish and install required castings and Materials in accordance with the Contract.

The Contractor shall carefully protect all reference points to the monuments and shall give the Engineer a minimum 5 Working Days advance notice of the schedule for monument work removal, and a minimum 2 Working Days advance notice of monument casting installation in order to avoid destruction of the survey points.

The survey monument will be furnished and set by the Engineer.

8-13.3(2) FURNISH AND PLACE MONUMENT CASTINGS

Where indicated on the Drawings, the Contractor shall furnish and install Type 020 monument frames and covers to the lines and grades established by the Engineer. See Standard Plan no. 020. Monument castings installed in concrete pavement or in rigid concrete pavement base shall comply with the requirements of Section 7-05.3(1)R.

8-13.3(3) ADJUST EXISTING MONUMENT CASTINGS TO GRADE

Existing monument castings shall be adjusted to grades in accordance with Section 7-20.3(1). Monument castings installed in concrete pavement or in rigid concrete pavement base shall comply with the requirements of Section 7-05.3(1)R.

8-13.3(4) RESET OR RELOCATE MONUMENT CASTINGS

See Section 8-13.3(1).

The Contractor shall carefully remove monument castings as required during construction and shall store the castings in a secure place.

Monument castings designated for removal and not reused on the Project, shall be carefully removed and salvaged in accordance with Section 2-02.3(7)A.

The monument castings shall be reset by the Contractor at *Street* grade in locations designated by the Engineer. *Monument castings installed in concrete pavement or in rigid concrete pavement base shall comply with the requirements of Section 7-05.3(1)R.*

The Contractor shall replace lost or damaged castings with new castings.

8-13.3(5) MISSING AND BROKEN CASTINGS, AND EXTRA WORK

Missing or damaged monument castings resulting from Contractor operations shall be replaced at no cost to the Owner in accordance with Section 8-13.3(2).

Monument castings not identified on the Drawings but found during construction to be missing, damaged, or substandard shall at the Engineer's discretion be reset or relocated in accordance with Section 8-13.3(2). Payment will be made in accordance with "Monument Frame and Cover".

Monument castings not identified on the Drawings for relocate or reset which are adversely impacted by extra Work or by specified Work shall at the Engineer's discretion be reset or relocated in accordance with Section 8-13.3(4). Payment will be either for "Reset Monument Frame and Cover" or for "Relocate Monument Frame and Cover".

Monument castings installed in concrete pavement or in rigid concrete pavement base shall comply with the requirements of Section 7-05.3(1)R.

8-13.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

8-13.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-13 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Monument Frame and Cover"**, per each.

The *Bid item price* for "Monument Frame and Cover" shall include all costs for the work required to furnish and set the monument castings.

2. **"Reset Monument Frame and Cover"**, per each.

The *Bid item price* for "Reset Monument Frame and Cover" shall include all costs for the work required to remove, store, and reset the monument castings.

3. **"Relocate Monument Frame and Cover"**, per each.

The *Bid item price* for "Relocate Monument Frame and Cover" shall include all costs for the work required to remove, store and reset the monument casting in a new location.

4. **Other payment information.**

Lost or damaged castings resulting from the Contractor's operations shall be replaced with a new Type 020 casting at no cost to the Owner. Castings damaged during installation shall be replaced and reinstalled at no expense to the Owner.

SECTION 8-14 CEMENT CONCRETE SIDEWALK**8-14.1 DESCRIPTION**

Section 8-14 describes work consisting of cement concrete sidewalks, thickened edge for sidewalk, monolithic curb and sidewalk, curb ramps, and bus shelter pads, including excavation and Subgrade preparation.

8-14.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Cement Concrete Class 5 (3/4) ¹	5-05.3
Portland Cement	9-01
Aggregates	9-03
Premolded Joint Filler	9-04.1
<i>Interlocking Concrete Paver Materials</i>	<i>9-14.9</i>
Concrete Curing Materials and Admixtures	9-23

Note ¹ Concrete sidewalk monolithic with handrail shall be Class 6 (3/4) (see Section 8-18.2 and Standard Plan nos. 442, 443a and 443b).

Slump of the concrete mix shall not exceed 3-1/2 inches.

Lamp black coloring agent for matching the color of newly constructed cement concrete sidewalks to the color of adjacent existing cement concrete sidewalks shall be added to the concrete during mixing in an amount not to exceed 1-1/2 pounds per cubic yard of concrete. No lamp black shall be used in curb ramps.

8-14.3 CONSTRUCTION REQUIREMENTS

8-14.3(1) GENERAL

The curb and gutter section shall be placed prior to the placement of the sidewalk section. Where sidewalk construction is in an area with exposed tree roots 2 inch or greater in diameter, the Contractor shall comply with the requirements of Section 1-07.16(2).

Tree grates for tree pits installed in the sidewalk shall have a concrete collar as specified in Section 8-02.3(21).

8-14.3(2) EXCAVATION AND SUBGRADE

Excavation for sidewalks shall be as described in Section 2-03. *Unsuitable material* in the Subgrade shall be removed to a depth determined by the Engineer and then backfilled with suitable Material.

Embankments shall be compacted by Method B as specified in Section 2-03.3(14)D.

Before the forms are set, the subgrade shall be graded to within 1 inch of established grade and the area between the sidewalk and the adjacent private property line shall be shaped to line, grade, and section shown on the Drawings.

If the Drawings call for sidewalk drains or the Engineer directs sidewalk drains to be installed, they shall be installed before forms are placed. Sidewalk drains shall be installed according to Section 7-01 and Standard Plan no. 241b.

8-14.3(3) FORMS AND FINE GRADING

Forms shall conform to requirements specified in Section 5-05.3. Wood forms shall be 2" x 4" (nominal) in lengths of not less than 10 feet. Steel forms may be used upon approval of the Engineer. Forms shall be staked to a true line and grade. A subgrade template shall then be set upon the forms and the fine grading completed so that the compacted subgrade shall be a minimum of 3-1/2 inches below the top of the forms. The Subgrade shall be thoroughly dampened prior to the time the concrete is placed.

Forms shall be provided around all *Street* name sign posts and *Traffic* sign posts that are placed in concrete areas. Forms used for this purpose shall provide a 1 foot square or 1 foot diameter blockout, as approved by the Engineer.

Forms for the curb section of monolithic curb and sidewalk shall be as specified in Section 8-04.3(1)A.

8-14.3(4) PLACING AND FINISHING CONCRETE

8-14.3(4)A PLACING CONCRETE

The concrete shall be spread uniformly between the forms and thoroughly consolidated to a minimum thickness of 3-1/2 inches. Through joints and dummy joints shall be located and constructed in accordance with Section 8-14.3(6). In construction of through joints, the premolded joint filler shall be adequately supported straight and vertical until the concrete is placed on both sides of the joint.

Whenever castings are located in the sidewalk area, joints shall be installed at the casting location to control cracking of the sidewalk. Concrete sidewalk placed around fire hydrant shall include reinforcing steel and a joint with 1/4 inch premolded *through* joint filler as detailed on Standard Plan no. 311a. *Concrete sidewalk placed to accommodate a tree pit with a tree grate shall include a concrete collar with reinforcing steel and a joint with 3/8 inch premolded joint filler, or a concrete thickened edge (see Section 8-02.3(21)).* If spacing of joints or scoring is such that installation of joint Material would be unsuitable, the Contractor shall install rebar to strengthen the sidewalk section as required by Section 5-05.3(9) for castings in the pavement area.

Dummy joints shall be formed by first cutting a groove in the concrete with a tee bar to a depth equal to, but not greater than the joint filler Material, and then working the premolded joint filler into the groove. Premolded joint filler for both through and dummy joints shall be positioned in true alignment at right angles to the line of the sidewalk and be normal to and flush with the surface. Where the sidewalk is contiguous with the curb, it shall be constructed with a thickened edge as shown on Standard Plan no. 420.

After the concrete has been thoroughly compacted and leveled, it shall be floated with wood floats and finished at the proper time with a metal float. Joints shall be edged with a 1/4 inch radius edger and the sidewalk edges shall be tooled with a 1/2 inch radius edger.

Additional requirements for placing concrete in cold weather shall be as specified in Section 5-05.3(14).

Placing concrete for the curb section of the monolithic curb and sidewalk shall be as specified in Section 8-04.3(1)B.

8-14.3(4)B FINISHING CONCRETE

The surface shall be brushed with a fiber hair brush of an approved type in a transverse direction except that at driveway and *Alley* crossings it shall be brushed in a longitudinal direction. The placing and finishing of all sidewalk shall be performed in a manner acceptable to the Engineer, and the tools used shall be acceptable to the Engineer. After brush finish, the edges of the sidewalk and all joints shall be lightly edged again with an edging tool to give it a finished appearance.

Sidewalk 120 feet in length or less, shall be scored to match the pattern of existing sidewalk to which new sidewalk joins unless otherwise specified in Contract. All other sidewalk shall be divided into panels by scoring 1/4 inch deep "V grooves" in the manner indicated on Standard Plan no. 420.

Additional requirements for finishing concrete in cold weather shall be as specified in Section 5-05.3(14).

8-14.3(5) CURING AND PROTECTION

The curing Materials and procedures specified in Section 5-05.3(13) shall prevail, except that white pigmented curing compounds shall not be used on sidewalks. The curing agent shall be applied immediately after brushing and shall be maintained for a period of 5 Days.

The Contractor shall have readily available sufficient protective covering, such as waterproof paper or plastic membrane, to securely cover the sidewalk pour of an entire Day in event of rain or other unsuitable weather.

The sidewalk shall be protected against damage or defacement of any kind until it has been accepted by the Owner.

Additional requirements for curing in hot weather shall be as specified in Section 5-05.3(13)C. Additional requirements for curing in cold weather shall be as specified in Section 5-05.3(14).

Curing for the curb section of the monolithic curb and sidewalk shall be as specified in Section 8-04.3(1)E.

8-14.3(6) THROUGH AND CONTRACTION JOINTS

Standard locations for through joints for sidewalks are:

1. At *Street* margins produced and at 30-foot or 28-foot intervals.
2. To separate concrete driveways, stairways, curb ramps and their landings from sidewalks.
3. Around the vertical barrel of fire hydrants, around utility poles and large diameter underground utility cover castings when located in the sidewalk area.
4. Longitudinally between concrete walks, curbs, paved planting strips and solid masonry or concrete walls where they abut.
5. To match as nearly as possible the through joints in the adjacent pavement and curb when sidewalk abuts curb.

Transverse contraction joints (dummy joints) shall be constructed with premolded joint filler 1/4-inch thick by 2 inches wide, and set at intervals of 15 feet or less. Where obstacles or shortened sidewalk lengths or non-regular shaped sidewalks are encountered, the location of joints shall be as indicated in Contract. At no time shall joint spacing exceed 15 feet.

Transverse and longitudinal through joints as shown on Standard Plan no. 420 shall be 1/2-inch thick premolded non-extruding joint Material. The joint Material width shall be cut to a width equal to the full depth of the concrete sidewalk plus 1/2-inch. When installed, the joint Material shall be placed with top edge 1/8-inch below the finished surface of the concrete in a plane perpendicular to the surface and with the bottom edge embedded in the subgrade. All joints shall be in straight alignment, except where placed in curved locations as required by the Drawings.

Construction joints for sidewalks shall conform to the applicable requirements for through joints for pavement except for thickness of joint Material being 3/8 inch and width of 2 inches. The top edge shall be 1/8-inch below the finished surface of the sidewalk. At no time shall joint spacing exceed 15 feet.

8-14.3(7) CURB RAMP, TYPE 1

Curb Ramp, Type 1 shall be installed with new sidewalk at locations indicated on the Drawings.

Curb ramp construction and alignment shall be as indicated on Standard Plan no. 422b unless indicated otherwise on the Drawings. Where curb ramps are to be constructed, the Contractor shall construct monolithic depressed curb and sidewalk. Curb ramps shall be constructed separately from the sidewalk to produce a definite break line between the ramp and the sidewalk. A 3/8 inch through joint premolded filler shall be installed between the curb ramp and the sidewalk with 1/4 inch concrete edging as specified in Section 8-14.3(4)A. See Standard Plan nos. 422a and 422b for joint locations.

The triangular shaped siding areas shall be brush finished with brushing parallel to the curb face. The adjacent sidewalk "V" groove scoring pattern shall not extend into the curb ramp siding areas. *The inclined plane of the ramp indicated on Standard Plan no. 422a and the inclined plane of the wing indicated on Standard Plan no. 422b shall have a coarse textured surface similar to the impression which is obtained through the use of a 3/4 inch x 9-11 flattened expanded metal mesh screen pressed into the fresh concrete. The long axis of the diamond shaped impression shall be perpendicular to the curb line for Standard Plan no. 422a ramps, and shall be parallel to the curb line for Standard Plan no. 422b ramps.*

The Subgrade for curb ramps shall be graded, compacted and formed to provide a minimum concrete depth of 6 inches adjacent to the curb and tapering to a minimum depth of 3-1/2 inches at the back terminus.

Concrete for curb ramps shall not contain any coloring additive, be overlaid, or be topped. Curb ramps shall be considered as beginning at a point flush with the pavement and terminating at a point flush with the sidewalk or sidewalk landing. *The ramp, landing area if required, and sloping triangular shaped wings indicated on Standard Plan no. 422a, and the landing area and ramps indicated on Standard Plan no. 422b, are considered part of the curb ramp.*

8-14.3(8) CURB RAMP, TYPE 2

Curb Ramp Type 2 shall be installed at locations indicated on the Drawings where new sidewalk is not required.

Curb Ramp Type 2 shall consist of the following work:

1. Saw cutting existing concrete sidewalk and curb required for curb ramp installation,
2. Removal and disposal of all sidewalk, asphalt, sod, etc., plus required excavation in the area of the curb ramp,
3. Removal and disposal of all curb, including pavement under the curb, from the area of the curb ramp,
4. Removal and disposal of all pavement and asphalt overlay from the face of the curb to the cut line used to remove the curb,
5. Installation of the curb ramp as described in Section 8-14.3(7), and
6. Replacement of all removed pavement to match existing.

8-14.3(9) BUS SHELTER FOOTING

The Contractor shall construct a bus shelter footing according to the details shown on Standard Plan no. 423 unless indicated otherwise on the Drawings. *Prior to construction, the Contractor shall notify METRO at least 10 Working Days in advance so that coordinating the installation of the bus shelter by METRO forces is accommodated.*

8-14.3(10) INTERLOCKING CONCRETE PAVERS**8-14.3(10)A GENERAL**

Cement concrete sidewalk and curbs shall be placed and cured prior to placing concrete pavers shown on Drawings.

8-14.3(10)B PRESSURE MOLDED INTERLOCKING CONCRETE PAVER**8-14.3(10)C BASE COURSE**

In areas where crushed rock base is to be placed between the existing Subgrade and the sand bedding layer, the base course shall be spread in layers not exceeding 4 inches after compaction. Compaction shall be at 95% maximum density while at optimum moisture in accordance with Section 2-09.

8-14.3(10)D BEDDING SAND

After crushed rock base course installation has been approved by the Engineer, the bedding sand shall be spread uniformly over the working area and screeded accurately to the limit indicated on the Drawings. *The screeded and leveled surface shall be loose and shall not be disturbed or compacted in any manner.* Any area of bedding sand, which becomes compacted by any means (including foot prints), shall be removed immediately, and the bedding sand shall be replaced and re-screeded to a loose compacted condition.

Sand shall not be placed more than 6 feet ahead of pavers. Sand shall not be allowed to sit overnight. Filter fabric shall be placed between the sand bed and the leveling course.

8-14.3(10)E PAVER BLOCK PLACEMENT

Pavers shall be placed on the screeded sand from the low side to the high side, in a herringbone pattern. Joints between pavers shall be 1/8 inch.

The pavers shall not be placed so that they are touching. Development of interlock depends on the use of narrow joints filled with compacted sand.

Full pavers shall be laid first with the gaps at the edges filled with standard edge pieces or with pieces cut to fit. The pieces shall not be less than 25% of a full paver. Pavers shall be cut to a straight even surface without cracks or chips. Cutting shall be done with a masonry saw or a guillotine cutter. The cut surface shall be at 90 degrees to the top/bottom of the paver. Any cut paver failing to meet this requirement shall be discarded.

Except where it is necessary to correct minor variations in the laying pattern, pavers should not be hammered into positions. The face shall be laid in such a manner that the paver is forced into a space.

It is required that pavers be laid from at least three bundles to minimize the effect of color variation. Premanufactured edging material shall be installed directly adjacent to concrete curb or sidewalk.

8-14.3(10)F COMPACTION

After placing the pavers, the Contractor shall use a vibrating plate compactor to consolidate the pavers and sand to the finished grade. Compaction shall be continued until the level of the pavers has stabilized.

The plate compactor shall be a high frequency, low amplitude vibrator of sufficient size to compact the sand layer and have a plate surface of at least 2-1/2 square feet.

Compaction shall be done as close as possible to within three (3) feet from the overlaid paver laying faces. At no time shall the length of uncompacted pavers exceed six (6) feet.

Initial compaction shall be completed before any joint filling.

The pavers shall be compacted at the completion of each day's laying.

Any pavers that are cracked or structurally damaged during compaction shall be removed and replaced at no expense to the Owner.

8-14.3(10)G FILLING JOINTS

As soon as practicable after compaction, joint filling sand shall be swept into joints. Excess sand shall be swept from the top surface of the pavers before vibrating. A vibrating plate compactor shall be run over the pavers to work the sand into the joints. This procedure shall be done until the joints do not need to receive any more sand.

The Contractor shall return one week after this last placement of sand to sweep and vibrate additional sand into the paver joints. This process shall be repeated on a weekly basis until the joints are filled and do accept no more sand.

8-14.3(10)H FINISHED SURFACE

After final compaction, the finished surface shall be true to grade and not vary by more than 1/8 inch when tested with a 10 foot straight edge. Any pavers or paver areas which do not meet these tolerances shall be removed and reset.

8-14.3(10)I MAINTENANCE

The pavement shall be maintained from installation through the maintenance period. Maintenance period shall be for two years from the date of acceptance.

Maintenance shall include, but not be limited to, the following:

1. Resetting settled pavers to finished grade, which have settled or rutted greater than 3/8 inch in 10 feet in any direction.
2. Periodic joint filling of sand shall be reviewed, *and performed as necessary*, on the following schedule: 1st week, 2nd week, 4th week, 3rd month, 6th month, 9th month, 12th month, 15th month, 18th month, 21st month, and 24th month.

8-14.3(11) **STRIPPING FORMS AND FINISHING – MONOLITHIC CURB AND SIDEWALK**

Stripping forms and finishing for the curb section of the monolithic curb and sidewalk shall be as specified in Section 8-04.3(1)D.

The concrete shall be cured for at least 72 hours by one of the methods specified in Section 5-05.3(13)B.

8-14.4 **MEASUREMENT**

Bid items of Work completed pursuant to *the Contract* will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs *herein* this Section.

Measurement for "Sidewalk, Cement Concrete" will be by the square yard for the surface of concrete walk placed. Deductions will be made for blocked out areas, castings, or other discontinuities in the sidewalk 9 square feet or larger.

Measurement for "Sidewalk, Thickened Edge" will be by the linear foot along the face of the thickened edge for the length constructed. *Measurement of thickened edge will not be made through curb ramps, driveways, or Alley access ramps.*

Measurement for Mineral Aggregate of the Type specified will be *in accordance with* Section 4-01.4.

Measurement for monolithic curb and sidewalk will be considered as three component sections as follows:

1. *The first component, "Sidewalk, Cement Concrete" will be that portion of the combined section not including the area within 6 inches of the curb face and will be the square yards of actual sidewalk constructed.*
2. *The second component, "Curb, Cement Concrete", will be that portion of the combined section beginning at back of curb and extending to the face of the curb, and will be the actual linear feet of curb constructed, as measured along the front curb face.*
3. *The third component, "Sidewalk, Thickened Edge", will be the triangular cross-sectional portion of the combined section below the bottom of sidewalk and butting against the back of the curb section. The thickened edge will be the actual linear feet of thickened edge constructed, as measured along the face of the thickened edge.*

Measurement for "Interlocking Concrete Pavers" will be by the square yard of total concrete paver surface area installed.

Measurement for "Interlocking Paver Maintenance, Min. Bid = ____" will be by lump sum.

In areas of existing improvement where a "cut-in" is required for new curb ramp, new driveway, or new Alley access driveway, the monolithic curb will be considered incidental to the new curb ramp, new driveway, or new Alley access driveway and no measurement for curb will be made (see Section 8-04.4).

8-14.5 **PAYMENT**

Compensation for the cost necessary to complete the work described in Section 8-14 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Sidewalk, Cement Concrete"**, per square yard.

The *Bid item price* for "Sidewalk, Cement Concrete" shall include all costs for the work required to construct the sidewalk as specified including the earth work required to excavate Material from the top surface of the sidewalk to the sidewalk Subgrade, Subgrade preparation, and furnishing and installing all Materials.

Payment for the volume of earth work involved in excavating Material above the top surface of the sidewalk will be made in accordance with Section 2-03 "Common Excavation".

All costs for reinforcing bars constructed around castings shall be included in the *Bid item price* for "Sidewalk, Cement Concrete".

2. **"Sidewalk, Thickened Edge"**, per linear foot.

The *Bid item price* for "Sidewalk, Thickened Edge" shall include all costs for the work required to construct the thickened edge where required.

3. **"Curb Ramp, Cement Concrete, (Type)"**, per each.

The *Bid item price* for "Curb Ramp, Cement Concrete, Type 1" shall include all costs for the work required to construct the curb ramp including the ramp, the sidewalks, joint Materials, and excavation.

The Bid item price for "Curb Ramp, Cement Concrete, Type 2" shall include all costs for the work required to remove existing improvement within area of new curb ramp and to construct the curb ramp at "cut-in" locations.

4. **"Bus Shelter Pad"**, per square yard.

The *Bid item price* for "Bus Shelter Pad" shall include all costs for the work required to construct the bus shelter pad.

5. **"Interlocking Concrete Pavers"**, per square yard.

The Bid item price for "Interlocking Concrete Pavers" shall include all costs for the work required to furnish and install the interlocking concrete pavers.

6. **"Interlocking Paver Maintenance, Min. Bid = _____", per lump sum.**

The Bid item price for "Interlocking Paver Maintenance, Min. Bid = _____" shall include all costs for the work required to maintain the interlocking paver area.

Should the Contractor determine that the cost for this work is greater than the Bid item lump sum minimum price listed in the Bid Form, the Contractor may bid a higher Bid item lump sum price by crossing out the Bid item lump sum minimum price and extension shown in the Bid Form, writing in a higher Bid item lump sum price and extension in the Bid Form, and initialing the change. Bids received on this Contract which contain a cost for interlocking paver maintenance of less than the Bid item lump sum minimum price shown in the Bid Form will be revised to reflect the Bid item lump sum minimum price allowed including the extension and shall govern as becoming a part of the Bid.

Payment shall be made at the rate of 25 percent of the Bid item lump sum price for "Interlocking Paver Maintenance, Min. Bid = _____" on the following payment dates: 25% on the last day of the sixth month, 25% on the last day of the twelfth month, 25% on the last day of the eighteenth month, and the final 25% on the last day of the twenty fourth month unless corrections or replacements are necessary and the Engineer has provided Written Notice of such. Should correction or replacement be required and the Contractor has made such correction or replacement, the Contractor shall at least 5 Working Days after all necessary corrections and replacements have been made, provide Written Notice of request for payment to the Engineer.

7. **Other payment information.**

Payment for imported Mineral Aggregate of the Type specified for sidewalk fill will be made in accordance with Section 4-01.5.

Payment for sidewalk drains will be made in accordance with Section 7-01.5.

Payment for monolithic curb and sidewalk or monolithic curb, gutter and sidewalk will be made for the Bid item measurements as described in Section 8-14.4.

Payment for relocations of signs will be made in accordance with Section 8-21.5.

Costs for finishes, edging, joints, joint Materials, and other minor work incidental to Section 8-14 constructions shall be included in the applicable Bid item prices.

Payment for furnishing and installing the concrete collar for tree grate will be paid as "Sidewalk, Thickened Edge".

SECTION 8-15 RIPRAP

8-15.1 DESCRIPTION

This Work shall consist of furnishing and placing riprap protection, including the furnishing and placing of geotextile and filter blanket protection of the type specified at the locations and to lines and dimensions shown on the Drawings or established by the Engineer.

Riprap will be classified as heavy loose, light loose, hand-placed, sack, and concrete slab riprap.

8-15.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Mineral Aggregates	9-03
Geotextile	9-05.22
Riprap and Quarry Spall	9-13

Filter Material shall meet the gradation requirements for *Mineral Aggregate Type 13, shoulder ballast*.

The geotextile shall be as specified in Section 9-05.22, Permanent Erosion Control, High Survivability. *The filtration Class of the geotextile will be specified in the Contract.*

Concrete for fire hydrant concrete slab and wall applications shall be Class 5 (3/4) (see Standard Plan no. 313).

8-15.3 CONSTRUCTION REQUIREMENTS

8-15.3(1) GENERAL

The foundation for riprap shall be excavated below probable scour or to the elevation shown on the Drawings. No stones shall be laid or concrete placed until the foundation is approved by the Engineer. Excavation below the level of the intersection of the slope to be riprapped and the adjacent original ground, or the channel floor, or the slope, shall be classified as ditch excavation in accordance with Section 2-10. Before placing riprap, the slopes shall be dressed to the lines and grades as staked by the Engineer.

Where specified in Contract, the slope or the area to be protected shall first be covered with a geotextile. A filter blanket shall be required for hand-placed riprap, sack riprap and concrete slab riprap. A filter blanket is a layer of selected aggregate, or a Mineral Aggregate Type, of specified thickness placed over the geotextile as a cushioning medium upon which the riprap is placed.

8-15.3(2) LOOSE RIPRAP

Loose riprap shall be placed in such a manner that all relatively large stones shall be essentially in contact with each other, and all voids filled with the finer Materials to provide a well graded compact mass. The stone shall be dumped on the slope in a manner that ensures the riprap attains its specified thickness in one operation. When dumping or placing, care shall

be used to avoid disturbing the underlying Material. Placing in layers parallel to the slope will not be permitted. A 12-inch tolerance for loose riprap will be allowed from slope plane and grade line in the finished surface.

8-15.3(3) HAND-PLACED RIPRAP

The stones shall be laid by hand on prepared slopes to such thickness as may be ordered by the Engineer. The riprap shall be started at the toe of the embankment by digging a trench and placing a course of the largest stones therein. Each stone shall be placed so that it shall rest on the slope of the embankment and not wholly on the stone below, and it shall be thoroughly tamped or driven into place. The exposed face of all hand-placed riprap shall be made as smooth as the shape and size of the stones permit and shall not vary more than 3 inches from a plane surface on the required slope.

8-15.3(4) SACK RIPRAP

Sack riprap conforming to the requirements of Section 9-13.4 shall be deposited in the trench and on the slope of the embankment to be protected in accordance with the Drawings.

The concrete shall be placed in the sacks to a uniform volume leaving sufficient room for effectively tying the sacks. The sacks shall then be placed in longitudinal rows in the trench and on the slope to lie parallel with the slope. In placing the sacks on the slope, their outside faces shall be laid against a heavy timber header or screed so that each layer is true to line and grade. The tied end of the sack shall be turned under and the sack firmly pressed into place against the header or screed. Each sack shall rest equally on two sacks below it such that vertical joints shall be staggered in succeeding horizontal rows. Sack riprap shall not be placed in freezing weather, and work damaged by frost shall be removed and replaced by the Contractor at no additional cost to the Owner.

8-15.3(5) CONCRETE SLAB RIPRAP

Concrete slab riprap for other than Standard Plan no. 313 applications shall consist of concrete placed in slabs 4 inches thick unless otherwise indicated in the Contract.

A trench of the dimensions shown on the Drawings or as staked by the Engineer shall be dug at the toe of the slope. The forms shall be of the depth of the concrete to be placed.

The panel length shall be 10 feet unless otherwise shown on the Drawings, and the concrete panels shall be placed in layers. The joints between panels in one layer shall alternate with the joints in progressive layers to present a staggered and regular joint pattern among all layers. Care shall be taken not to injure the concrete in place when constructing the fill-in panels. Expansion joint Material will not be required at the joints.

The concrete shall be placed and rodded true to the plane of the embankment and shall be finished smooth by troweling or other methods approved by the Engineer. The edges shall be tooled to a 1/2 inch radius.

The riprap shall be protected from flood waters and tides during the hardening of the concrete.

Weep holes shall be constructed every 10 feet. All Material placed in back of the riprap and within 18 inches of weep holes shall be gravel backfill for drains.

8-15.3(5)A CONCRETE SLAB FOR HYDRANT WALL REQUIREMENTS

Concrete slab for use on fire hydrant wall requirements as shown on Standard Plan no. 313 shall be no less than 3'-0" in length and no less than 1'-6" in width. The depth of concrete slab shall be no less than 3 1/2 inch. The side of each concrete slab to be visible on the face of the hydrant wall shall be straight. Broken concrete sidewalk meeting the dimension requirements of this Specification Section are acceptable. All concrete slab shall be intact with no visible cracking. The minimum thickness of concrete slab wall shall be 1'-6" and the filter layer behind the concrete slab wall shall be no less than a 6 inch thickness of Mineral Aggregate Type 2. The concrete slabs need not be cemented together. If the concrete slabs are required to be cemented together, weep holes are required with a spacing along the wall face not exceeding 5 feet with each weep hole located within 1 foot above finished grade.

The concrete slab wall shall be constructed in horizontal layers with vertical joint spacing offset between adjacent layers. Each horizontal layer shall have uniform thickness and each individual concrete slab shall be set stable with no rocking.

8-15.3(6) QUARRY SPALLS

Quarry spalls shall be placed in ditches and channels, and on slopes to be protected in accordance with the Contract. After placement, the quarry spalls shall be compacted by tracked Equipment making a minimum of three passes. On steep slopes, the Contractor shall compact the quarry spall in a manner approved by the Engineer.

8-15.3(7) FILTER BLANKET

When required, a filter blanket shall be placed on the prepared slope or area to the thickness specified on the Drawings using methods which do not cause segregation of particle sizes within the bedding. The surface of the finished layer shall be even and free from mounds or windrows. Additional layers of filter Material, when required, shall be placed using methods which do not cause mixing of the Materials in the different layers.

8-15.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Loose riprap will be measured by the ton of riprap actually placed.

Hand-placed riprap will be measured by the cubic yard of riprap actually placed.

Filter Material will be measured by the cubic yard actually placed.

Sack riprap will be measured by the cubic yard. The number of cubic yards of sack riprap placed shall be computed from the number of sacks of cement actually used in the concrete mix and the yield per batch of concrete as determined from actual measurement.

Concrete slab riprap will be measured by the cubic yard based on the dimension of all slabs in-place as a whole.

Quarry spalls will be measured by the ton of spalls actually placed.

Geotextile will be measured by the square yard as specified in Section 2-12.4.

8-15.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-15 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Heavy Loose Riprap"**, per ton.
2. **"Light Loose Riprap"**, per ton.
3. **"Hand-Placed Riprap"**, per cubic yard.
4. **"Sack Riprap"**, per cubic yard.
5. **"Concrete Slab Riprap"**, per cubic yard.

The *Bid item prices* for "Heavy Loose Riprap", for "Light Loose Riprap", for "Hand-Placed Riprap", for "Sack Riprap", and for "Concrete Slab Riprap" shall include all costs for the work required to furnish and install the riprap of the type specified including all excavation and backfill above the level of the intersection of the slope to be riprapped and the adjacent original ground or the channel floor or channel slope as specified in Section 8-15.3(1). When it is necessary to dump and sort individual loads, payment will be made only for that portion accepted by the Engineer.

6. **"Quarry Spalls"**, per ton.

The Bid item price for "Quarry Spalls" shall include all costs for the work required furnish and install quarry spall.

7. **"Filter Material"**, per cubic yard.

The Bid item price for "Filter Material" shall include all costs for the work required to furnish and install filter material.

8. **Other payment information.**

Payment for ditch excavation as defined in Section 8-15.3(1) will be made in accordance with Section 2-10.5.

Payment for "Geotextile" will be made in accordance with Section 2-12.5.

All costs in connection with constructing the weep holes and with excavation and backfilling with gravel backfill for drains, as specified in Section 8-15.3(5), shall be included in the *Bid item price* for "Concrete Slab Riprap".

SECTION 8-16 CONCRETE SLOPE PROTECTION

8-16.1 DESCRIPTION

This Work shall consist of constructing concrete slope protection, in accordance with these Specifications and the details shown on the Drawings, at the locations and in conformity with the lines, grades, and dimensions as staked by the Engineer.

8-16.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Concrete Class B	6-02
Concrete Slope Protection	9-13
Wire Mesh	9-07.7

8-16.3 CONSTRUCTION REQUIREMENTS

8-16.3(1) FOOTING AND PREPARATION OF SLOPE

The footing for the slope protection shall be constructed in accordance with Sections 2-09 and 6-02.

The surface on which application is to be made shall be thoroughly compacted and neatly trimmed to line and grade as necessary to conform to the detail on the Drawings.

8-16.3(2) PLACING SEMI-OPEN CONCRETE MASONRY UNITS

The concrete masonry units shall be placed in a uniform plane, as indicated on the Drawings, in such a manner that they rest firmly and evenly against the slope with no rocking. The concrete masonry units shall be placed in horizontal parallel courses, and successive courses shall break joints with the preceding course to form a running bond.

8-16.3(3) CAST IN PLACE CEMENT CONCRETE

The wire mesh shall lap a minimum of one mesh spacing, and laps shall be securely fastened at the ends. During the placement of the concrete, the reinforcement shall be supported in place so as to provide a minimum of 1-1/4 inches of cover.

Where Class B cement concrete is to be placed upon the slope, the method of depositing and compacting shall result in a compact, dense, and impervious concrete which shows a uniformly plane surface.

The newly constructed concrete shall be finished by means of a wood float and shall be striated with a rustication joint as shown on the Drawings.

Curing shall be performed in accordance with Section 5-05.3(13).

8-16.3(4) PNEUMATICALLY PLACED CONCRETE

Workers: Only workers experienced in pneumatically placed concrete shall be employed; and acceptable evidence of such experience shall be submitted when requested by the Engineer.

Equipment: The Contractor shall submit to the Engineer two copies of the manufacturer's specifications and operating instructions for the Equipment used. Before placement of any portion of the slope protection, the type of Equipment and method of operation shall be approved by the Engineer.

Proportions of Materials: The sand/cement ratio shall be 4-1/2 parts sand to 1 part cement based on loose dry volume.

Water shall be maintained at a constant pressure which shall be at least 15 psi above atmospheric pressure at the nozzle. For lengths of hose up to 100 feet, pneumatic pressure at the gun shall be 45 psi or greater. Pressure shall be increased 5 psi for each additional 5 foot increment over 100 feet of hose required. A steady pressure shall be maintained.

Method of Application: Portland cement and sand shall be mixed dry, passed through a cement gun and conveyed by air through a flexible tube, hydrated at a nozzle at the end of the flexible tube, and deposited in place by air pressure.

All surfaces are to be wetted, but application shall not be made on any surface on which free water exists.

Reinforcement: The wire mesh shall lap a minimum of one mesh spacing, and laps shall be securely fastened at the ends. During the placement of the concrete, the reinforcement shall be held so as to provide a minimum of 1-3/4 inches of cover at the recess.

Finishing: The newly constructed concrete shall be finished by means of a wood float and shall be striated with a rustication joint as shown on the Drawings.

Curing: Curing shall be in accordance with Section 5-05.3(13).

Protection of Facilities: During the construction, the Contractor shall protect all retaining walls, columns and Structures from concrete splash or overspray. Suitable covering shall be provided if such protection is deemed necessary by the Engineer.

Test Cylinders: Two test cylinders shall be made for each full Day's operation. The Contractor shall furnish the cylinders 6 inches in diameter and 12 inches high made of 3/4-inch mesh hardware cloth. The test cylinder shall be filled with concrete by utilizing the same pneumatic application described above. Contact the SPU Materials Laboratory at 386-1236 for coordinating pick-up of the test cylinders and for testing requirements.

The cylinders will be tested for the minimum compressive strength for Class B (see Section 6-02.3) at the age of 28 Days, unless another Class of concrete is specified in the Contract.

8-16.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for concrete slope protection will be by the square yard and will include the actual area of the slope protection face covered excluding the footings. Footings will be measured by the cubic yard within neatlines indicated on the Drawings (see Section 6-02.5).

8-16.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-16 will be made at the Bid item price Bid only for the Bid item listed or referenced as follows:

1. "Concrete Slope Protection", per square yard.

The Bid item price for "Concrete Slope Protection" shall include all costs for the work required to construct the slope protection including the Work required to construct the footing.

SECTION 8-17 RESERVED

SECTION 8-18 CEMENT CONCRETE STAIRWAYS, LANDINGS, AND STEPS

8-18.1 DESCRIPTION

This Work shall consist of constructing, on a prepared compacted Subgrade, cement concrete stairways, landings, steps, and handrails, and bike path handrails, and such subsidiary Work as may be necessary, in accordance with these Specifications and in conformity with the lines, grades, and cross sections indicated on the Drawings. See Standard Plan nos. 440a, 440b, 441, 442, 443a, and 443b.

8-18.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Cement Concrete	5-05
Portland Cement	9-01
Aggregates	9-03
Joint & Crack Sealing Materials, and Non-Shrink Grout	9-04
Concrete Curing Materials and Admixtures	9-23

The concrete mix shall be Class 6 (3/4) for steps and stairways. Landings shall be Class 5 (3/4). Sidewalk monolithic with handrail shall be Class 6 (3/4).

Galvanized steel pipe railing shall be fabricated from standard weight steel pipe meeting the requirements of ASTM A 53. After fabrication, the railings shall be hot-dipped galvanized per ASTM A 123. Gripping handrail shall be standard steel pipe meeting the requirements of ASTM A 53 and shall be 1 inch nominal diameter (1.315 inch outside diameter) as specified in the American Institute of Steel Construction Manual.

Aluminum paint for handrails shall be Formula D-1-57 aluminum paint meeting the requirements of Section 9-08.2.

Wood for railings shall be as indicated on the Drawings.

Reinforcing Steel shall be ASTM A 615, Grade 60.

8-18.3 CONSTRUCTION REQUIREMENTS

8-18.3(1) SITE PREPARATION AND GRADING

At locations where cement concrete stairways, landings, or steps are to be constructed, the area shall be cleared, grubbed, excavated, graded, and prepared in accordance with Sections 2-01 and 2-03 to the limits indicated on the Drawings or staked by the Engineer. *Where stairways, landings, or step construction is in an area with exposed tree roots 2 inch or greater in diameter, the Contractor shall comply with the requirements of Section 1-07.16(2).*

8-18.3(2) SUBGRADE PREPARATION AND FORMS

The necessary Subgrade preparation and compaction required in the construction of cement concrete stairways, landings, and steps shall meet the requirements for pavement Subgrade preparation set forth in Section 2-06.

Forms shall meet the requirements of Section 5-05.3(21) except that wood side forms shall be not less than 2 inches nominal in thickness and shall be straight and true.

8-18.3(3) REINFORCING STEEL

Reinforcing steel for cement concrete stairways shall be placed as shown on Standard Plan nos. 440a through 443b. The reinforcing steel shall be assembled and securely tied with annealed wire of not less than No. 16 gauge at each bar lap or crossing and be rigidly supported above the Subgrade during the concrete placement.

8-18.3(4) HANDRAIL

Handrails shall be of welded steel pipe construction, fabricated and installed as indicated on Standard Plan nos. 440a, 440b, 442, 443a, and 443b unless the Contract specifies otherwise. Welds shall be made by certified welders and each weld shall be ground and buffed to a smooth surface. Rails shall be hot dip galvanized according to ASTM A 123 after fabrication. If field welds are required, they shall be coated with a zinc alloy solder to a minimum thickness of 2.0 mils per ASTM A 780.

Either the railing shall be placed completely assembled at the time when stairway concrete is placed, or recesses shall be provided in the concrete for grouting the railing posts after the concrete has been placed, finished, and cured. The installed railing shall be in true alignment, on proper grade, and with posts plumb.

8-18.3(5) PLACING, FINISHING, AND CURING CONCRETE

Placing, finishing and curing concrete shall conform to the applicable requirements in Section 5-05.3.

Front and side edging of concrete stair treads shall be to a radius of 1/2 inch.

Landings for stairways shall be scored as specified for concrete sidewalks in Section 8-14 except that transverse and longitudinal scoring shall be modified as necessary to result in uniform size of squares in each landing. Where gutters are along the side of the stairways, the gutter portion of stairway landing shall be smooth finished without markings to conform with the stairway gutter.

8-18.3(6) GUTTER

Where Type 440 stairway is called for in the Contract, or where a stairway gutter is called for in the Contract, the concrete gutter shall be constructed in accordance with the detail on Standard Plan no. 440b. The gutter shall be constructed along and outside the stairway, adjacent to the concrete walk or landing that joins flights of stairs connecting the stairway gutters, and shall be sloped for continuous flow.

8-18.3(7) STEPS

Steps shall be constructed in accordance with Standard Plan no. 441.

Treads shall range from a maximum 12 inch to a minimum 11 inch. Risers shall range from a maximum 7 inch to a minimum 5 inch. Within any single flight of stairs, the difference in the largest and shortest tread run, and the difference in the highest and lowest riser height, shall not exceed 3/8 inch respectively.

8-18.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs *herein* this Section.

Excavation for stairways, landings, and gutters will be measured by the cubic yard of common excavation in accordance with Section 2-03.

Measurement of "Steps, Cement Concrete" and "Stairway, Cement Concrete, Special" will be by the square foot of tread surface installed.

"Stairway, Cement Concrete, Type 440" will be measured by the linear foot for the horizontal distance from a point 2 feet 2 inches from the back of the top tread to a point 2 feet 2 inches from the face of the bottom riser for the width indicated in the Contract.

Handrail of the type specified will be by the linear foot of actual handrail installed measured along the top of the top rail from end post to end post including the posts.

Concrete landings or walkways outside the stairway measurement limits will be measured as "Sidewalk, Cement Concrete" by the square yard in accordance with Section 8-14. Asphalt walks will be measured in accordance with Section 5-04.

Gutter will be measured by the linear foot along the gutter end to end including stairway slope, landing, and concrete walk.

8-18.5 PAYMENT

Compensation for the costs necessary to complete the work described in Section 8-18 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Stairway, Cement Concrete, Type 440"**, per linear foot.

The Bid item price for "Stairway, Cement Concrete, Type 440" shall include all costs for the work required to construct the concrete stairway to the width indicated in the Standard Plans.

2. **"Stairway, Cement Concrete, Special"**, per square foot.

The Bid item price for "Stairway, Cement Concrete, Special" shall include all costs for the work required to construct a stairway in accordance with Standard Plans for Type 440 Stairway for a width other than indicated in the Standard Plans.

3. **"Handrail, (Type)"**, per linear foot.

The Bid item price for "Handrail, (Type)" of the type specified shall include the costs for the work required to furnish, fabricate and install the handrail along the stairway or sidewalk.

4. **"Steps, Cement Concrete"**, per square foot.

The Bid item price for "Steps, Cement Concrete" shall include all costs for the work required to construct concrete steps.

5. **"Gutter, Cement Concrete, Type 440"**, per linear foot.

The Bid item price for "Gutter, Cement Concrete, Type 440" shall include all costs for the work required to construct a gutter section along the edge of stairways and landings.

6. **Other payment information.**

Payment for excavation required for stairways, landings, and gutter sections will be paid as "Common Excavation" in accordance with Section 2-03.

Payment for concrete landings and walkways will be made as "Sidewalk, Cement Concrete" in accordance with Section 8-14.

Reinforcing steel shall be considered as incidental to the Bid item price for the appropriate Bid item.

SECTION 8-19 CEMENT CONCRETE DRIVEWAY

8-19.1 DESCRIPTION

This Work shall consist of cement concrete driveway and Alley constructed at the locations shown on the Drawings and shall be in accordance with Section 8-19 and Standard Plan nos. 430 and 431.

Driveways for Alleys and commercial access shall be 8 inch minimum depth.

8-19.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Cement Concrete	5-05
Portland Cement	9-01
Fine and Coarse Aggregates	9-03.1
Joint and Crack Sealing Materials	9-04
Reinforcing Steel	9-07
Curing Materials and Admixtures	9-23
Water	9-25.1

The cement concrete mix shall be as specified for Class 6 (1-1/2) or Class 6 (3/4).

8-19.3 CONSTRUCTION REQUIREMENTS

8-19.3(1) EXCAVATION AND SUBGRADE

Subgrade preparation for driveways and the required compaction shall conform to the applicable requirements in Section 2-06 to provide a firm, unyielding Subgrade, acceptable to the Engineer. *Where driveway construction is in an area with exposed tree roots 2 inch or greater in diameter, the Contractor shall comply with the requirements of Section 1-07.16(2).*

Driveways for accessing Alleys and for commercial Traffic shall be excavated to accommodate an 8 inch minimum thickness concrete driveway. Driveways for residential access shall be excavated to accommodate a 6 inch minimum thickness concrete driveway.

8-19.3(2) FORMS AND FINE GRADING

Forms shall have a height of not less than the specified depth of concrete to be placed and shall be of ample strength to resist deformation. All forms shall be securely staked and braced plumb and true to line and grade.

A template shall be set upon the forms, and the Subgrade shall be fine graded and compacted to conform to the required section. Prior to the placement of concrete, the Subgrade shall be thoroughly dampened.

8-19.3(3) PLACING AND FINISHING CEMENT CONCRETE DRIVEWAY

The concrete shall be spread uniformly and consolidated between the forms (See Section 6-02.3(9)). *Through joints and contraction joints shall be located in accordance with Standard Plan nos. 430 and 431.* The concrete driveway shall be brush finished with the sidewalk portion scored as specified in Section 8-14.3(4)B. In the construction of through joints, the premolded joint filler shall be adequately supported until the concrete is placed on both sides of the joint.

Contraction joints (dummy joints) shall be formed with a tee bar by first cutting a groove in the concrete to a depth equal to, but not greater than the joint filler Material and then working the premolded joint filler into the groove. Premolded joint filler for both through joints and dummy joints shall be positioned in true alignment and at right angles to the center line of the driveway or *Alley crossings*.

After the concrete has been thoroughly compacted and leveled, it shall be floated with wood floats and finished at the proper time with a metal float. Joints shall be edged with 1/4 inch radius edger and the driveway or *Alley* return edges shall be tooled with 1/2 inch radius edger. Curbs shall be tooled with a 1 inch radius edger.

The surface shall be brushed in a transverse direction in relation to the center line of the driveway or *Alley* return with a fiber hair brush of approved type.

Driveways and *Alley crossings* shall not be constructed at the same time the pavement is placed.

8-19.3(4) CURING AND PROTECTION

Curing Materials and procedures shall be as specified in Sections 9-23 and 5-05.3(13).

Before placing any concrete, the Contractor shall have enough protective plastic sheet or other suitable protection at the Project Site to protect the newly placed concrete of an entire Day in the event of rain or other unsuitable weather conditions.

8-19.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs *herein* this Section.

Measurement for cement concrete driveway and *Alley* return will be by the square yard for the class and thickness of driveway actually placed, measured from the back of the curb to the back of the sidewalk.

8-19.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-19 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Driveway, Cement Concrete, (Thickness)"**, per square yard.
2. **"Driveway, Cement Concrete, HES, (Thickness)"**, per square yard.

The *Bid item prices* for "Driveway, Cement Concrete, (Thickness)" and for "Driveway, Cement Concrete, HES, (Thickness)" shall include all costs for the work required to construct the driveway including excavation and Subgrade preparation.

3. **Other payment information.**

Payment for *Alley* return will be made as "Driveway, Cement Concrete, (Thickness)".

Payment for excavation below the prepared Subgrade and additional selected Materials will be made as "Common Excavation" per Section 2-03.5 and as "Mineral Aggregate, (Type)" per Section 4-01.5.

No separate or additional payment will be made for driveway thickness, or for common excavation, greater than the thickness specified in the Contract.

SECTION 8-20 RESERVED

SECTION 8-21 PERMANENT SIGNING, AND PARKING METER POSTS

8-21.1 DESCRIPTION

Section 8-21 describes work consisting of furnishing and installing new Traffic signs, Street designation signs, Owner furnished Street name signs, bus zone signs, posts, and parking meter posts with or without signs; relocating existing Traffic signs, Street name signs, and posts in accordance with the Drawings, these Specifications, and with Standard Plan nos. 601b through 630. The removal of signs shall be as specified in Section 2-02.3(3)K.

8-21.2 MATERIALS

Materials shall meet the requirements of the following Sections:

<i>Non-Shrink Cement Sand Grout</i>	<i>9-04.3(2)</i>
<i>Signing & Post Materials, and Jet Set Cement</i>	<i>9-28</i>

Sign post Material shall be standard grade western red cedar.

8-21.3 CONSTRUCTION REQUIREMENTS**8-21.3(1) SIGN INSTALLATION****8-21.3(1)A TRAFFIC SIGN**

All Traffic signs will be provided by SDOT. To order signs, the Contractor shall provide 10 Working Days advance notification to the Engineer and shall specify the number(s) and type(s) of signs needed. SDOT will notify the Contractor of when the signs are ready for pickup. The Contractor shall pickup the signs at the SDOT sign shop at 4200 Airport Way South on weekdays between the hours of 8:00 AM to 3:00 PM.

The multiple panel signs and sign Structures shall be installed in accordance with the Drawings, the Standard Plans, and signing details included in the appendix of the Project Manual.

The sign shall be mounted level and face in the direction indicated on the Drawings or designated by the Engineer.

When mounting a sign on a wood post or wood pole, 5/16-inch x 3-1/4-inch galvanized or cadmium plated lagscrews shall be used, with 1/8-inch thick x 1-inch O.D. nylon washers. For details, see Standard Plan nos. 620 and 621.

When mounting a sign on a steel pole 0.1793 inch or thicker, the "drill & tap" method or rivnuts shall be used with 5/16-inch stainless steel bolts and 1/8-inch thick x 1-inch O.D. nylon washers. For a steel pole less than 0.1793 inch, 5/16-inch stainless steel rivnuts shall be used. *On an aluminum pole, 5/16-inch bolts and aluminum rivnuts shall be used.*

Field repair of galvanized surfaces of drill holes shall be done with galvanized repair paint meeting the requirements of Federal Specification MIL-P-21035 (Ships) paint, high zinc dust content, galvanizing repair.

When mounting a 9-inch x 12-inch or larger sign on a parking meter post, the Contractor shall use 1/4-inch x 3-1/2-inch galvanized bolts, galvanized nuts, and 1-inch O.D. nylon washers. A smaller sign on a parking meter post shall be mounted with 1/4-inch x 3/4-inch galvanized self-tapping screws with 1-inch O.D. nylon washers. For details, see Standard Plan no. 628.

Signs mounted on span wire or mast arms shall be mounted as indicated on the Drawings and in *Traffic* signing details shown in Standard Plan nos. 601b and 612. Sag in the span shall be maintained between 5 percent and 7 percent of the span length. Clearance between the bottom of the sign and the roadway centerline shall be maintained between a minimum 17 feet and a maximum 19 feet. Use standard signal mounting hardware & span wire assemblies in accordance with Section 8-31. For mast arm mounting use aluminum C3X2.1 by "Drill & Tap" method.

8-21.3(1)B STREET NAME, STREET DESIGNATION, AND BUS ZONE SIGNS

All Street name, Street designation, and bus zone signs will be provided by SDOT. To order signs, the Contractor shall provide 10 Working Days advance notification to the Engineer and shall specify the number(s) and type(s) of signs needed. SDOT will notify the Contractor of when the signs are ready for pickup. The Contractor shall pickup the signs at the SDOT sign shop at 4200 Airport Way South on weekdays between the hours of 8:00 AM to 3:00 PM.

Street name and Street designation signs shall be mounted as indicated on the Traffic signing details shown in the Standard Plans, unless indicated otherwise in the Contract.

Bus zone signs shall be installed as indicated on Standard Plan no. 630. Bus zone post installation shall be direct burial unless specified otherwise on the Drawings.

8-21.3(2) POST INSTALLATION**8-21.3(2)A SIGN POST INSTALLATION**

Holes for wood sign post shall be of sufficient size to allow placement and compaction of backfill Material completely around the posts. Selected backfill Material shall be placed and compacted to meet the requirements of Section 2-03. The area disturbed during wood sign post installation shall be surfaced to match the surrounding surfaces. Where a wood sign post is to be installed in an existing paved concrete area, a neat 12-inch x 12-inch cut-out shall be provided by saw cutting, or an 8-inch diameter hole shall be provided by core drilling.

Where the Drawings or the Engineer require a *Traffic* sign post to be located within the area of new sidewalk paving, the Contractor shall provide a 12-inch square or a 12-inch diameter blockout, with depth to match the thickness of the proposed paving.

After a post is installed, and backfilled and compacted with selected Material, the cutout or blockout shall be filled with Material matching surrounding Material and capped with additional Material from 3/4-inch above surrounding finished grade to finished grade, to shed water away from the post. Where concrete is the surrounding Material, a 3/4 inch preformed joint Material shall be placed in the joint. See Standard Plan nos. 620, 621, 624, and 626 for details.

When required, Street name sign and bus zone sign posts shall be installed in an 8-inch diameter post hole, and backfilled with Class 5 drypack concrete as indicated in Standard Plan nos. 622 and 630.

8-21.3(2)B PARKING METER POST INSTALLATION

Parking meters shall be mounted either on direct burial meter posts or on surface-mounted meter posts.

Direct burial parking meter posts shall be installed plumb as indicated on Standard Plan no. 629. Backfill shall be Material specified in Section 9-28.2(2)B and shall be mounded for drainage.

Surface-mounted meter posts shall be installed with accessories, as applicable and as indicated on Standard Plan nos. 627 and 628, and shall have a 5/16-inch thick base plate welded to the bottom with 1/4-inch fillet weld all around. The base plate and anchors shall be covered with a metal canopy made of spun aluminum as specified in Section 9-28.2(2)C and filled with a non-shrink cement sand grout meeting the requirements of Section 9-04.3(2).

Direct burial and surface mounted parking meter posts not also used for signs shall have a steel sleeve fitted loosely over the full length of exposed parking meter post (Standard Plan no. 629 shows the sleeve on a direct burial post). The sleeve shall be cut and reamed free of burrs to a length extending from contact with the ground or canopy, to where the base of the parking meter.

Where a meter post is used as a sign post with no parking meter, a galvanized metal cap shall be placed over the galvanized post. The cap shall receive one undercoat and 2 finish coats of black exterior enamel. For cap installation details, see Standard Plan nos. 627 and 628.

8-21.3(3) SIGN COVERING

As indicated in the Contract, the Contractor shall be prepared to provide a temporary covering to hide or expose select signs for public convenience. The covering shall consist of 4 mil minimum thickness black polyethylene sheeting of sufficient size to cover the entire face or faces of the sign, shall extend over the edges of the sign, and shall be either securely fastened on the back of a single face sign or securely fastened to itself on a double face sign. The Contractor shall not use any type of Material which may permanently adhere to the face of the sign or damage the face of the sign. The covering, and method of fastening the covering to the sign, is subject to the approval of the Engineer.

8-21.3(4) SIGN RELOCATION

Existing signs and sign posts shall be relocated to new locations called out on the Drawings or designated by the Engineer. Temporarily stockpiled signs and posts shall be protected against loss or damage. Removal of signs and posts required for "sign relocation" shall conform to Section 2-02.3(3)K.

Reinstalling posts shall comply with Section 8-21.3(2).

8-21.3(5) SIGN CLEANING

Signs shall be thoroughly cleaned after relocation or installation. The Contractor shall not use cleaning solvents that harm the sign finish.

8-21.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Sign, Traffic" will be by the square foot of sign measured on one face only.

Measurement for "Sign, Street Name, (Owner Furnished), Street Name Post Mounted" will be by each. One unit of measurement will consist of all Street name sign blades together with all block number plates mounted on Street name sign post.

Measurement for "Sign, Street Name, (Owner Furnished, Steel/Aluminum Pole Mounted" will be by each. One unit of measurement will consist of 2 (two) Street name sign blades together with 2 (two) block number plates mounted on steel or aluminum pole.

Measurement for "Sign Covering" will be by the square foot of sign covered measured on one face only.

8-21.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-21 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Sign, Traffic"**, per square foot.
2. **"Sign, Street Designation"**, per each.

The Bid item prices for "Sign, Traffic" and for "Sign, Street Designation" shall include all costs for the work required to furnish the sign and mounting hardware and mount the signs.

3. **"Sign, Street Name (Owner Furnished), Street Name Post Mounted"**, per each.

The Bid item price for "Sign, Street Name (Owner Furnished), Street Name Post Mounted" shall include all costs for the work required to mount one unit of Owner furnished Street name sign blades and block number plates. The Owner will furnish the sign mounting hardware as indicated on Standard Plan nos. 622 and 623.

4. **"Sign, Street Name (Owner Furnished), Steel/Aluminum Pole Mounted"**, per each.

The Bid item price for "Sign, Street Name (Owner Furnished), Steel/Aluminum Pole Mounted" shall include all costs for the work required to mount one unit of Owner furnished Street name sign blades and block number plates. The Contractor shall furnish all the sign mounting hardware.

5. **"Sign, Bus Zone (Owner Furnished)"**, per each.

The *Bid item price* for "Sign, Bus Zone (Owner Furnished)" shall include all costs for the work required to install the Owner furnished post including concrete foundation, and mounting the Owner furnished bus zone sign including the mounting hardware.

6. "Post, Traffic Sign", per each.
7. "Post, Parking Meter", per each.
8. "Post, Street Name", per each.
9. "Post Bus Zone", per each.

The *Bid item prices* for "Post, Traffic Sign", for "Post, Parking Meter", for "Post, Street Name", and for "Post Bus Zone" shall include all costs for the work required to furnish and install the specified post including foundation, selected backfill and surface restoration. The *Bid item price* for "Post, Street Name" shall include all costs for installing Owner furnished Street name sign.

10. "Relocate Sign, Traffic", per each.
11. "Relocate Sign, Street Name", per each.
12. "Relocate Sign, Bus Zone", per each.

The *Bid item prices* for "Relocate Sign, Traffic", for "Relocate Sign, Street Name", and for "Relocate Sign, Bus Zone" shall include all costs for the work required to remove and relocate the *Traffic* sign, *Street* name sign or bus zone sign including posts, foundations, disposal, and cleaning as specified. If a new post is installed on the new location, the post will be paid for separately. No payment will be made for the post when furnished by the Owner.

When relocating *Street* name signs to a newly installed *Street* name sign post, the relocation cost shall be incidental to the cost of installing the post.

Where the Drawings indicate the relocating of *Street* name sign to an existing Steel or Aluminum Pole, the Contractor will be paid for relocating the *Street* name signs under Bid item "Relocate Sign, Street Name". This shall include removal of *Street* name signs, mounting on the pole, and furnishing and installing mounting brackets and hardware in accordance with the Standard Plans.

Payment for the removal and replacement of surrounding improvement shall be in accordance with the Bid items in the Bid Form.

13. "Sign Covering", per square foot.

The *Bid item price* for "Sign Covering" shall include all costs for the work required to furnish and install the covering Material as specified. Removal of sign covering shall be considered incidental to the *Bid item price* for sign covering. Covering any signs for the convenience of Contractor's activities prior to new channelization shall be at the Contractor's expense.

14. Other payment information.

Payment for signing work related to the maintenance and protection of Traffic control will as specified in Section 1-10.5.

SECTION 8-22 PAVEMENT MARKING

8-22.1 DESCRIPTION

8-22.1(1) GENERAL

This Work shall consist of furnishing and installing pavement markings upon the roadway surface at locations shown on the Drawings, or where designated by the Engineer, in accordance with these Specifications and *Standard Plan nos. 700 through 722*. Pavement markings shall be for channelization, warnings, instructions, or curb usages.

8-22.1(2) PAVEMENT MARKING DESIGNATIONS

Pavement markings are defined as follows:

I. Paint		
Item Designation	Description	Usage
L-1	Two parallel solid 4-inch yellow stripes with 4-inch space between stripes	Double center line (Major Arterials)
L-2	Solid 4-inch yellow stripe	Median line
L-3	Dashed 4-inch yellow stripe (10 feet paint with 20 feet skip)	Centerline (Minor Arterials)
L-4	Solid 4-inch yellow stripe with parallel dashed 4-inch yellow strips (10 feet paint with 20 feet skip) with 4-inch space between the two paint stripes	One side of two-way left turn lane
L-5	Dashed 4-inch white stripe (10 feet paint with 20 feet skip)	Lane line
L-6	4-inch white stripe	Approach line, edge line, guide line
L-7	4-inch white stripe	Parking stall line
L-8	8-inch white stripe	Barrier line, crosswalk and crosshatch

L-8A	16-inch white stripe	Stop bar
L-8B	24-inch white stripe	Stop bar
L-10	6-inch white curb stripe	Various zones
L-11	6-inch red curb stripe	Tow-away zone
L-12	6-inch yellow curb stripe	Various zones
L-13	6-inch combination curb stripe (3 feet red - 4 feet yellow - 3 feet red)	Bus zone
L-17	Left and right arrow combination	
L-18	Oblique left arrow	
L-19	Oblique right arrow	
L-20	Left arrow	
L-21	Right arrow	
L-22	Through arrow	
L-23	Left and through arrow combination	
L-24	Right and through arrow combination	
L-25	"ONLY" legend	
L-26	"OK" legend	
L-27	Pedestrian symbol	
L-28	Bicyclist symbol (include arrows)	
L-29	Disabled person symbol	
L-30	"Bus" legend	
L-31	"Lane" legend	
L-32	"Carpool" legend	
L-33	Diamond symbol	
L-35	"School" legend	

II. Thermoplastic (Denoted by "T" Suffix)		
Item Designation	Description	Usage
L-8T	8-inch white stripe	Crosswalk
L-8AT	16-inch white stripe	Stop bar
L-8BT	24-inch white stripe	Stop bar
L-17T	Left and right arrow combination	
L-18T	Oblique left arrow	
L-19T	Oblique right arrow	
L-20T	Left arrow	
L-21T	Right arrow	
L-22T	Through arrow	
L-23T	Left and through arrow combination	
L-24T	Right and through arrow combination	
L-25T	"ONLY" legend	
L-26T	"OK" legend	
L-27T	Pedestrian symbol	
L-28T	Bicyclist symbol (include arrows)	
L-29T	Disabled person symbol	
L-30T	"Bus" legend	
L-31T	"Lane" legend	
L-32T	"Carpool" legend	
L-33T	Diamond symbol	
L-35T	"School" legend	

III. Pressure Sensitive Tape (Denoted by "S" Suffix)		
Item Designation	Description	Usage
L-10S	4-inch white curb tape	Various zones
L-11S	4-inch red curb tape	Tow-away zone
L-12S	4-inch yellow curb tape	Various zones
L-13S	4-inch combination curb tape (3 feet red - 4 feet yellow - 3 feet red)	Bus zone
L-14S	4-inch white tape	Parking meter stall, motor cycle stall, barrier area

8-22.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Pavement Marking Materials	9-29
----------------------------	------

Glass beads shall comply with the specifications for adherence coated glass spheres as approved by WSDOT Headquarters Materials Laboratory, 1655 South Second, Tumwater, Washington 98502.

Paint, and sprayed or extruded plastic Material, shall be applied with a top dressing of glass beads. Material for pavement marking shall be paint and/or thermoplastic as specified in the Contract.

8-22.3 CONSTRUCTION REQUIREMENTS**8-22.3(1) PRELIMINARY SPOTTING**

The Engineer will provide the preliminary layout as indicated on the Drawings for permanent pavement marking alignment following paving operations by the Contractor. Preliminary layout will consist of providing the Contractor with necessary control points at intervals agreed upon with the Contractor to enable the Contractor to complete the preliminary spotting of the pavement marking alignment before marking begins. Control points for crosswalks will be marked near or adjacent to the curb. Control points for stop lines will be marked near or adjacent to the curb and at the center line. Control points for legend and symbols shall be the responsibility of the Contractor. *Legend and symbols shall be placed in accordance with the 700 series Standard Plans at locations indicated on the Drawings.* Approval by the Engineer shall be obtained before installation begins. Preliminary spotting to guide the striping machine is required for all longitudinal lines except where a clearly visible separation is present.

Permanent pavement markings such as crosswalks, stop lines, center lines, legends and lane stripes shall be installed by the Contractor within 5 Working Days, weather permitting, after preliminary layout of the control points has been completed by the Engineer. Temporary pavement marking tape for centerline or lane lines or other pavement markings, if required by the Engineer, shall be installed in accordance with Section 5-04.3(17). Temporary pavement marking tape shall meet the requirements of Section 9-29.4.

8-22.3(2) PREPARATION OF SURFACES

Surface dirt and all contaminants within the areas to receive pavement markings shall be removed. Large areas of tar, grease or foreign Materials may require sandblasting, steam cleaning, power brooming, or chemical stripping to accomplish complete removal. Grass obstructing curb painting shall be trimmed to the back edge of the curb and the curbs cleaned of foreign Material before painting.

Existing pavement markings shall be completely removed. Cleaning and removal methods used shall not damage the pavement surface to a depth or width greater than that required to provide adequate bond between the pavement and the pavement marking Material. The pavement surface shall be approved by the Engineer before application of the markings.

8-22.3(3) PAINTED PAVEMENT MARKING**8-22.3(3)A GENERAL**

Equipment used for application of pavement markings shall be designed and operated to produce painted pavement markings of uniform quality to meet all specified requirements.

Traffic paint shall be applied at a rate of not more than 100 square feet per gallon (approximately 15 mils wet thickness). This rate is effectively 16 gallons of paint per mile of solid 4-inch wide line, which will be the basis for the measurement of yield. A tolerance not to exceed minus 10 percent will be allowed for film thickness or yield in paint application.

On "ladder type" crosswalks, pedestrian and bicyclist symbols (including arrows), white sharp sand shall be spread over fresh paint at a rate of approximately 1 pound per 20 square feet.

8-22.3(3)B TOLERANCES FOR STRIPES

The allowable tolerances for line striping are as follows:

1. **Length of Stripe:** The longitudinal accumulative error within a 30-foot length of lane line shall not exceed plus or minus 1 inch.
2. **Width of Stripe:** The width of stripe shall not vary more than plus or minus 1/4 inch.

3. **Lane Width:** The lane width, which is defined as the lateral width from the edge of pavement to the center of the lane line or between the centers of successive lane lines, shall not vary from the widths shown *on the Drawings* by more than plus or minus 4 inches.

8-22.3(4) THERMOPLASTIC PAVEMENT MARKING

8-22.3(4)A TYPE "A" INSTALLATION

The thermoplastic pavement marking shall be applied to an initially dry pavement surface after sufficient time has elapsed to insure that the primer, if required, has adequately dried and further curing of the primer does not adversely affect the thermoplastic Material.

Type "A" thermoplastic Material shall be applied in accordance with the manufacturer's recommended temperature ranges for ambient air temperature, pavement temperature, and temperature of the molten Material.

Hot-laid thermoplastic Material shall be applied to the pavement by a gravity or an extrusion method, or a combination of both. If the stripe width is obtained by two or more side-by-side applications, the adjacent applications shall be fused together with no apparent overlap or gap.

Glass beads, Type II, shall be applied separately to the thermoplastic Material as it is being placed. The glass beads shall be uniformly distributed over the entire width of thermoplastic Material so that no objectionable irregularities in the Material's reflectorization occur. The beads shall be applied separately and uniformly at the rate of 1 pound for every 50 square feet of pavement marking. The dispenser shall be located behind and controlled simultaneously with the pavement marking extrusion die such that the beads are imbedded in the pavement marking to a depth of at least 1/2 the bead diameter.

8-22.3(4)B TYPE "B" INSTALLATION

Type "B" prefabricated thermoplastic Material shall be applied to the pavement in a manner which provides a uniform surface over the various widths required. At application, the ambient air temperature shall be within the range recommended by the manufacturer.

Type "B" thermoplastic Material may be supplied complete with a precoated, factory applied adhesive, or may be furnished with separate adhesive, as recommended by the manufacturer. Whether precoated or supplied separately, the adhesive shall be such as to allow the thermoplastic Material to be repositioned on the pavement surface before permanently fixing it in its final position with a downward pressure.

When completed, the pavement markings shall not be less than 0.06 inches (1.5 millimeters) in thickness, exclusive of any precoated adhesive Material, and shall have a uniform cross-sectional configuration.

If the required pavement marking width is 12 inches or more, it may be fabricated from 12-inch or 6-inch wide Material. Longitudinal splices will be permitted, provided the gap at any splice does not exceed 1/16 inch.

Excess thermoplastic Material left on the pavement shall be removed prior to continuation of the operation.

8-22.3(5) PRESSURE SENSITIVE TAPE PAVEMENT MARKING

Application procedures for pressure sensitive tape shall be as recommended by the tape manufacturer. *The Contractor shall submit these recommendations to the Engineer at least 2 Working Days in advance of usage.*

8-22.3(6) REMOVAL OF PAVEMENT MARKING

Removal of pavement marking shall be in accordance with Section 2-02.3(3)J.

8-22.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1 Measurement of Quantities unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Pavement Marking, Paint, (Width) Stripe" will be by the linear foot of stripe, except dashed center lines and dashed lane lines will be measured as continuous lines with no deduction for the unpainted area caused by the skip pattern specified.

Measurement for "Pavement Marking, Paint, Legend/Symbol" will be by each legend or symbol.

Measurement for "Pavement Marking, Thermoplastic, 8-inch stripe" will be by the linear foot of 8-inch stripe actually placed and will not include unmarked space.

Measurement for "Pavement Marking, Thermoplastic, Legend/Symbol" will be by each legend or symbol.

The legends "ONLY" and "OK" will be measured as 1 unit each.

The symbol "Bicyclist" with "Arrows" will be measured as 1 unit each.

Stop lines, 16 or 24 inches wide and comprised of multiple 8-inch wide stripes, will be measured by the linear foot of 8-inch width stripe.

Measurement for "Pavement Marking, Pressure Sensitive Tape" will be by the linear foot of tape actually placed and will not include unmarked space.

8-22.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-22 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "Pavement Marking, Paint, (Width) Stripe", per linear foot.
2. "Pavement Marking, Paint, Legend/Symbol", per each.

3. "Pavement Marking, Thermoplastic, 8-inch Stripe", per linear foot.
4. "Pavement Marking, Thermoplastic, Legend/Symbol", per each.
5. "Pavement Marking, Pressure Sensitive Tape", per linear foot.

The Bid item prices for the above listed Bid items shall include all costs for the work required to furnish and install the specified types of pavement marking.

SECTION 8-23 RESERVED

SECTION 8-24 RESERVED

SECTION 8-25 GLARE SCREEN

8-25.1 DESCRIPTION

This Work shall consist of furnishing and constructing glare screen of the types specified, in accordance with the Drawings, these Specifications, and WSDOT Standard Plan nos. L-5 and L-5a.

Glare screen consists of diamond-woven wire mesh fence of aluminum, galvanized iron or aluminum-coated steel wire fabricated and placed to reduce glare from headlights of opposing *Traffic* or other adjacent light sources.

8-25.2 MATERIALS

Materials shall meet the requirements of Section 9-16.6.

8-25.3 CONSTRUCTION REQUIREMENTS

8-25.3(1) GLARE SCREEN FABRIC

Glare screen fabric shall be placed on the face of the posts designated by the Engineer. On curves the fabric shall be placed on the face of the post which is on the outside of the curve.

The fabric shall be stretched taut and securely fastened to the posts. Fastening to end, brace, and pull posts shall be with stretcher bars and fabric bands spaced at 1-foot intervals. The fabric shall be cut and each span attached independently at all pull and corner posts. Fabric shall be securely fastened to line posts with tie wires, metal bands, or other approved methods at 14 inch intervals. The top and bottom of the fabric shall be fastened to the tension cable and tension wire with hog rings spaced at 24-inch intervals.

Rolls of wire fabric shall be joined by weaving a single strand into the end of the rolls to form a continuous mesh.

8-25.3(2) SLATS

The slats shall be fastened into the weave by using staples, screws, or other methods as approved by the Engineer. Allowing the tension of the mesh to hold the slats in place will not be permitted.

Slats broken or split during construction shall be removed and replaced by the Contractor at no expense to the Owner.

8-25.3(3) POSTS

Posts, other than for Type 1 Design A, shall be constructed in accordance with the *WSDOT Standard Plans* and applicable provisions of Section 8-12.3(2)A.

Posts for Type 1 Design A shall be bolted to the beam guardrail posts as detailed in *WSDOT Standard Plan* no. L-5. Drilling of the guardrail posts shall be done in such a manner to ensure that the glare screen posts are set plumb and centered over the guardrail posts.

All round posts for Type 1 Design B, and Type 2 glare screen shall be fitted with a watertight top securely fastened to the post. Line posts shall have tops designed to carry the top cable.

8-25.3(4) TENSION WIRE

Tension wires shall be attached to the posts as detailed in the *WSDOT Standard Plans*.

8-25.3(5) TENSION CABLES

The tension cable shall pass through the top of the line post. One continuous length of cable shall be used between pull posts. Sufficient tension shall be applied to the cable to allow a maximum sag of 1/4-inch between posts after the chain link mesh has been attached to the cable. The Contractor shall provide temporary bracing on pull posts when applying tension to one length of cable at a time to prevent undue stresses on the pull post.

The cable shall be fastened to the top of the pull post with an eye bolt through the post and a turnbuckle connecting the eye bolt to the cable. Pull posts shall be braced to the bottom of the end or anchor posts with a short length of cable or tension wire as shown in the *WSDOT Standard Plans*. All turnbuckles shall have a minimum of 1-inch takeup clearance after tensioning.

The ends of all cables shall be seized with annealed iron wire for a distance of at least 1 inch.

8-25.3(6) FITTINGS, ATTACHMENTS, AND HARDWARE

A lead washer shall be placed against the shoulder of the eye nut, eye bolt, or backup nut, and a lead washer backed by the steel washer shall be placed between the pipe and lock washer, and the nut tightened sufficiently to seal the hole in the pipe.

A galvanized iron strap 1/4 inch in thickness by 12 inches in width, formed as shown in the *WSDOT Standard Plans*, shall be provided for the attachment of eye bolts to the base of the H column post in order to take the strain of the cable tension off the web of the H column.

8-25.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement of glare screen will be by the linear foot of completed glare screen for the particular type and design specified.

8-25.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-25 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "Glare Screen Type 1 Design _____", per linear foot.
2. "Glare Screen Type 2", per linear foot.

The Bid item price for glare screen of the type and design specified shall include all costs for the work required to furnish and assemble in place the completed installation including excavation, backfilling, tamping, concrete footings, miscellaneous hardware, smoothing the irregularities of the ground at the site, clearing the line for the glare screen, and disposing of all debris.

SECTION 8-26 RESERVED

SECTION 8-27 PROJECT IDENTIFICATION SIGN

8-27.1 DESCRIPTION

Section 8-27 describes work consisting of either furnishing and installing Project identification signs at the Project Site in accordance with these Specifications and with the Contract, or installing Owner furnished Project identification signs.

The quality of Contractor provided signs and supports shall be such that they present a workmanlike appearance with the paint remaining in good condition for the duration of the Project.

The Work also includes removing and disposing of the signs and supports after construction is completed or when directed by the Engineer.

8-27.2 MATERIALS AND FABRICATION

8-27.2(1) GENERAL

Project identification signs shall be constructed with Medium Density Overlay plywood, or shall be Owner provided. Descriptions of Owner furnished signs will be provided in the appendix of the Project Manual.

8-27.2(2) PLYWOOD

Plywood signs shall be made of Medium Density Overlay plywood meeting the requirements of "Products Standard PS 1-83 for Softwood Plywood, Construction and Industrial" grade, published by the Products Standards Section of the U.S. Department of Commerce. The plywood shall be free of contaminants which would adversely affect the application and life of the paint. Face veneers shall be Grade B or better.

Core and crossband veneers shall be solid. Core veneers shall be jointed. Core gaps shall not exceed 1/8 inch in width. The entire area of each contacting veneer surface shall be bonded with a waterproof adhesive that meets the requirements of the U.S. Department of Commerce for exterior type plywood.

The overlay shall be high density type. It shall have a minimum weight of 60 pounds per thousand square feet and shall be at least 0.012 inches thick before pressing. The overlay shall have a sufficient resin content to bond itself to the plywood, a content equal to 45 percent of the dry weight of the impregnated fiber.

The sign dimensions shall be as shown on the Drawings. The thickness of the single panel plywood sign shall be 1/2-inch.

8-27.2(3) SIGN BORDERS

Every Project identification sign shall have a border frame of 2 X 4's as shown in the Contract.

8-27.2(4) LETTERING AND SPACING FORMULA

Letters and symbols shall be of the type, size, and color specified in the Contract.

Letters and symbols shall be of Material compatible with the sign surface Material recommended by the sign surface manufacturer.

The Contractor shall submit one sample of a finished Project identification sign for the Engineer's approval prior to fabricating the remaining signs required under this Contract.

8-27.2(5) SIGN SUPPORTS

Posts and wood supports shall be 4-inch x 4-inch meeting the requirements of Section 9-09.2 Preservative treatment for posts and wood supports shall be as required in Section 9-09.3. Project identification signs shall be securely mounted either to the posts, or to the wood supports and supporting framework. Posts shall be of a length capable of installing in the

ground to a minimum depth of 3 feet below grade. The signs shall be mounted to be level and in a vertical plane. Backfill around the posts shall be reasonably compacted to provide adequate lateral support to prevent movement caused by moderate wind conditions. The wood supports and framework shall be sturdy and shall be installed to provide the needed stability to prevent movement caused by moderate wind conditions.

8-27.3 CONSTRUCTION REQUIREMENTS

8-27.3(1) LOCATION OF SIGNS

The Contractor shall install Project identification signs at locations indicated on the Drawings. Signs facing in each direction of Traffic shall be placed at all Project Sites prior to construction. Signs shall be placed so as to convey their message effectively without restricting lateral clearances or sight distance. When the Engineer requires the Contractor to relocate signs, sign support shall be as required in Section 8-27.2(5).

8-27.3(2) SIGN REMOVAL

The Contractor shall remove all Project identification signs, posts, and supports from the Project Site when Work is completed at that location or when required by the Engineer. When the Engineer directs a sign to be relocated, removal of the sign, posts, and wood supports and supporting frame shall be done in such a manner as to prevent disturbance or damage to the sign, wood support and supporting frame. Should the sign, post(s), or wood support(s) be disturbed or damaged, the Contractor shall restore the sign to an acceptable condition, or provide an identical sign or post or support, as necessary, at no cost to the Owner. The Engineer will determine if new posts, or new wood supports and framework, are required to accommodate a reasonably different site terrain where signs are to be relocated.

All removed Materials become the property of the Contractor and shall be removed from the Project Site.

The area(s) shall be restored to pre-existing or better condition immediately after removal.

8-27.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Sign, Project Identification" and for "Sign, Project Identification, Owner Furnished" will be per each sign actually used on the Project Site.

Measurement for "Relocate Project Sign" will be per each.

Measurement for posts, and for wood supports and supporting framework, will be per each sign.

8-27.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-27 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "Sign, Project Identification", per each.

The Bid item price for "Sign, Project Identification" shall include all costs for the work required to fabricate, paint, install, remove and dispose of signs, and restore all area(s) after Project completion.

2. "Sign, Project Identification, Owner Furnished", per each.

The Bid item price for "Sign, Project Identification, Owner Furnished" shall include all costs for the work required to pickup and deliver, install, remove and dispose of signs, and restore the area(s) after Project completion.

3. "Posts, Project Sign", per each sign.

The Bid item price for "Posts, Project Sign" shall include all costs for the work required to furnish, fabricate, install, maintain, relocate, and remove the posts, or wood supports and supporting frame, for each Project sign.

4. "Relocate Project Sign", per each.

The Bid item price for "Relocate Project Sign" shall include all costs for the work required to relocate a Project sign and posts or wood supports and support frame as specified.

5. Other payment information.

No additional payment will be made for signs requiring restoration or replacement if disturbed or damaged by Contractor operations.

No additional payment will be made for post(s) or wood support(s) and support frame(s) if disturbed or damaged by Contractor operations.

Relocation of a Project sign to a different site where a significant change in the original post(s), or wood support(s) and supporting frame, is necessary to accommodate different terrain or other conditions, will be paid as "Posts, Project Sign".

SECTION 8-28 RESERVED

SECTION 8-29 WIRE MESH SLOPE PROTECTION

8-29.1 DESCRIPTION

Section 8-29 describes the work consisting of constructing wire mesh slope protection in accordance with these Specifications and the details shown in WSDOT Standard Plan nos. D-7 and D-7a and in conformity with the lines and dimensions shown on the Drawings.

8-29.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Wire Mesh Slope Protection	9-16.4
----------------------------	--------

8-29.3 CONSTRUCTION REQUIREMENTS**8-29.3(1) ANCHORS**

The Contractor shall install anchors of the type shown in conformance to the layout shown on the Drawings. The spacing and number of the anchors and cables as shown on the Drawings are approximate only, and the Engineer will arrange the spacing in such a manner as to hold the wire mesh against the slope. Backfill Material shall be thoroughly compacted.

8-29.3(2) CABLE ASSEMBLY

The cable assembly shall be in place before the wire mesh is attached. The bottom cable shall not be tensioned. No cable splicing will be allowed.

8-29.3(3) WIRE MESH

The wire mesh shall be fastened to the completed cable assembly as shown in the WSDOT Standard Plan nos. D-7 and D-7a. Hog rings on the vertical lap splices shall be placed in a single row centered on the splice. Horizontal splices joining two rolls of mesh shall be made by removing a horizontal end wire and reweaving through the ends of the fabric to form a continuous mesh. All top and bottom laps shall be made by folding the mesh to the outside, away from the slope, to avoid the possibility of falling material hanging up in the folds. The bottom of the mesh shall be located so that material dislodged under the mesh can drain freely from the bottom, yet does not flow or bounce onto the Roadway. The ends of all tie wires shall be secured to the mesh with a minimum of 1-1/2 turns.

The wire mesh shall not be tensioned in any direction but is to remain loose so as to increase its dampening effect on rolling rocks. The Contractor shall use care in the handling and installing of the wire mesh and cable. Any mesh or cable damaged due to the Contractor's operations shall be replaced by the Contractor at no additional cost to the Owner.

8-29.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement of anchors will be per each for the completed anchor. Anchor types will not be differentiated.

Galvanized wire mesh will be measured by the square foot of the completed area.

Galvanized wire rope will be measured by the linear foot of wire rope actually used for the slope protection work.

8-29.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-29 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. "Wire Mesh Slope Protection Anchor", per each.

The Bid item price for "Wire Mesh Slope Protection Anchor" shall include all costs for the work required to furnish and install the anchors of the type required including removing obstructions, excavating, drilling, backfilling and grouting.

2. "Galvanized Wire Mesh", per square foot.
3. "Galvanized Wire Cable", per linear foot.

The Bid item price for "Galvanized Wire Mesh" and for "Galvanized Wire Cable" shall include all costs for the work required to furnish and install the wire mesh and the cable, including all rings, U-bolts, thimbles, wire rope, clips, hog rings, and tie wire necessary to complete the wire mesh slope protection.

SECTION 8-30 ILLUMINATION AND ELECTRICAL SYSTEMS**8-30.1 DESCRIPTION****8-30.1(1) GENERAL**

Section 8-30 describes the work consisting of furnishing and installing a complete and functional illumination and electrical system as specified in the Contract and in accordance with these Standard Specifications and the Standard Plans.

Service connections and energizing of illumination and electrical Street lighting systems to overhead secondary or to secondaries in vaults or handholes will be made by Seattle City Light. The Contractor shall provide the Engineer at least 10 Working Days advance notice unless otherwise arranged with the Engineer.

Required permits for electrical Work other than Street lighting and signals, and other than irrigation (see Section 8-03.1), shall be obtained in accordance with Section 1-07.6.

The Contractor shall become thoroughly familiar with the electrical environment within the Project Site and with the relevant Work.

8-30.1(2) APPLICABLE ELECTRICAL CODES

In addition to the safety rules and standards specified in Section 1-07.1(2), electrical Work shall be performed in accordance with the current applicable provisions of the following codes:

1. SCL Material Standards, SCL Construction Guidelines, and Requirements for Electrical Service Connection.

2. State of Washington Electrical Workers Safety Rules, Chapter 296-45 WAC.
3. National Electrical Code.
4. City of Seattle Electrical Code Supplement.
5. Edison Electric Institute (EEI).
6. National Electric Safety Codes.
7. National Electric Safety Code C2-1997.

8-30.1(3) **ELECTRICAL SHOP DRAWINGS**

The Contractor shall submit Shop Drawings to the Engineer of the following items in accordance with Section 1-05.3.

1. Luminaires (include photometrics and socket position)
 - a. Lamps
 - b. Wire
 - c. Ground Rods
 - d. Fuse Kits
 - e. Photoelectric Cells
 - f. Wire Connectors
 - g. Ground Clamps
 - h. Splice Kits

8-30.1(4) **ELECTRICAL AND ELECTRONIC WORDS AND PHRASES**

See Section 1-01.3.

8-30.2 **MATERIALS**

Materials shall meet the requirements of the following Sections:

Illumination and Electrical Materials, Luminaires, Ground Rods & Clamps	9-31
---	------

All welds on tubular steel shall comply with the requirements of ANSI/AWS D1.1 Section 10 Tubular Structures.

8-30.3 **CONSTRUCTION REQUIREMENTS**

8-30.3(1) **GENERAL**

To maintain safe Traffic conditions, existing luminaires shall remain in service until cut-over to new luminaires can be accomplished. Roadways shall not be opened to Traffic before all of the required lighting system is operating properly.

8-30.3(2) **LUMINAIRES**

The luminaire glassware, reflector and lamp shall be thoroughly cleaned before installation on the tenon on the bracket arm. The luminaire shall be secured and adjusted according to the manufacturer's recommendations. The luminaire refractor shall be level in the transverse Roadway axis and parallel to the Roadway grade in the longitudinal Roadway axis after the pole has been plumbed with all loads added, according to SCL Construction Guidelines D12-9.

Date of installation shall be marked on the bottom of the photoelectric cell with an indelible ink. The luminaire shall have the installation date marked in the metal base adjacent to the photo cell.

The photoelectric cell receptacle shall be adjusted such that the photoelectric cell faces north.

8-30.3(3) **RESERVED**

8-30.3(4) **RELOCATING EQUIPMENT**

When Equipment and associated Material is to be relocated, the Contractor shall furnish and install all the Equipment and Material, including additional new Material as necessary, required to complete the installation. All Material and Equipment shall meet the requirements of these Specifications.

8-30.3(5) **WIRING, FUSING, AND SPLICING**

Individual luminaire fuses shall be rated at 10 amps except for 400 watt luminaires at 120 volts which shall be rated at 15 amps.

Festoon outlets shall be fused at 15 amps.

The Contractor shall provide wiring from luminaire terminal boards to in-line fuseholders and to the source of secondary service.

The Contractor shall coil a minimum 8 feet of wire at the source of secondary service to allow for connections by Seattle City Light. The Contractor shall coil 3 feet of excess conductor in each type handhole.

Each "hot" conductor shall have an in-line fuseholder and fuse located as indicated on the Drawings. Poles fed underground shall be fused in the pole base and shall have at least 3 feet of wire above the pole base to provide sufficient slack wire so the fuseholders can be withdrawn through the pole handhole for servicing.

Wire attached to the face of a wood pole, not enclosed in conduit, shall be covered with plastic molding meeting SCL Material Standards.

Caution shall be exercised in working near and within Seattle City Light Vaults and the electrical distribution system. Voltages present can be 26,000 volts or higher. Vault wiring will not be de-energized while the qualified Contractor is working. The Contractor shall arrange for scheduling a Seattle City Light Electrical Safety Observer when Work is required in a Seattle City Light vault or near an electrical distribution facility in accordance with Sections 1-05.2(2).

When cables or single conductors are being installed, care shall be exercised not to exceed tension limitations recommended by the manufacturer. Conductors may be pulled directly by hand; however, conductors pulled by mechanical means require a dynamometer with drop-needle hand shall be used on every pull. On mechanical pulls, either the insulation

shall be stripped off each conductor, and conductors formed into a pulling eye and firmly taped before pulling, or a cable grip shall be used. The pulling force shall be applied directly to the conductor.

Secondary insulator racks required for new construction shall be in accordance with SCL Material Standards and installed in accordance with SCL Construction Guidelines.

Where new cable is to be installed in existing conduits which are occupied, the Contractor shall protect existing wiring from damage. Cable pulling compound shall be used to minimize cable pulling tensions and adverse effects on existing wire insulation, jacket and shield. Care shall be exercised in pulling cable into poles and pedestals since sharp metal edges may be present.

Aluminum wire and connectors shall be prepared and coated with an oxide-inhibiting compound.

Where triplex wire is installed overhead to feed only one Street light, the two hot conductors shall be tied together (brothered) at each pole.

Wire insulation shall be removed by a method that does not "ring" or nick the wire. "Ringing" will be cause for rejection of the splice.

Wire splices shall be made mechanically and electrically secure. Each individual splice or termination of extra leads shall be insulated and made waterproof.

All cables shall be marked with a permanent waterproof tag in handholes or access points with feed point circuit number.

For above ground splices, the connector shall be torqued to the manufacturer's recommended level. The splice and termination of extra leads shall be covered with rubber base insulating and waterproofing tape as specified in SCL Material Standards. This tape shall be worked around the wire insulation to insure a water tight assembly. The splice assembly shall be protected with two layers of electrician tape.

For below ground splices, connectors shall be tightened or crimped in accordance with the manufacturer's specifications. Only manufacturer's approved crimping tools shall be used to compress crimp splices. The metal splice shall be centered in the enclosure. The encapsulant shall be mixed and installed in accordance with manufacturer's recommendation. The encapsulant shall completely fill the enclosure and be free of voids and impurities.

Where festoon outlets are installed on poles a separate circuit shall be provided.

8-30.3(6) RESERVED

8-30.3(7) GROUNDING AND BONDING

All metallic appurtenances containing electrical conductors, including cabinets, metallic conduit, metal poles, pedestals, and junction boxes, shall be made mechanically and electrically secure to form a continuous system which shall be effectively grounded.

Where conduit (including steel conduit) systems are used, all metallic appurtenances shall be electrically bonded by a separate insulated ground conductor.

Where parallel electrical circuits exist in an electrical conduit, the Equipment grounding conductor shall be sized as determined by the rating of the largest overcurrent device serving any circuit contained in the conduit (minimum size shall be #8 copper). Only one Equipment grounding conductor is required in any conduit.

All conduit runs with phase conductors (with the exception of the run from the riser to the first handhole) shall have a ground wire installed in the conduit unless noted otherwise on the Drawings.

A ground wire shall interconnect all ground rods in each circuit.

Metal conduit, ground wires and the service neutral shall be bonded and grounded at the service entrance point as required under the NEC and the City of Seattle Electrical Code.

Only one wire shall be installed under any ground clamp.

Ground rods shall be installed in firm undisturbed earth. In areas with loose or soft soil conditions, extensions shall be coupled until the rod cannot be removed by hand. Minimum spacing between ground rods shall be 6 feet.

8-30.3(8) REMOVAL AND SALVAGE OF EXISTING EQUIPMENT

Refer to Section 2-02.3(3)G and 2-02.3(7)C.

8-30.3(9) FIELD TESTING

Prior to completion of the Work, the Contractor shall provide the Engineer 3 Working Days advance notice and make the following tests on all electrical circuits:

1. Test for grounds in each circuit by physically examining the installation to ensure that all required ground jumpers, devices and appurtenances are in place, that they are mechanically and electrically firm, and that they meet the requirements of Article 250 of the National Electrical Code.
2. Insulation resistance test (with all readings recorded when requested by the Engineer). The insulation test shall be performed after all field connections have been made.
3. A functional test in which it is demonstrated that each and every part of the system functions as specified or intended herein. The functional test shall be performed after all field connections are completed.

8-30.3(10) FINAL INSPECTION

See Section 1-05.11.

8-30.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

8-30.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-30 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Luminaire, High Pressure Sodium, (Wattage), Roadway"**, per each.

The Bid item price for "Luminaire, High Pressure Sodium, (Wattage), Roadway" shall include all costs for the work required to furnish and install a complete luminaire including the fuse, hardware, photoelectric cell and wiring to the fuseholder at the secondary source or at the base of the pole.

2. **"Luminaire, High Pressure Sodium, (Wattage), Underdeck Mounted"**, per each.

3. **"Luminaire, High Pressure Sodium, (Wattage), Wall Mounted"**, per each.

The Bid item prices for "Luminaire, High Pressure Sodium, (Wattage), Underdeck Mounted" and for "Luminaire, High Pressure Sodium, (Wattage), Wall Mounted" shall include all costs for the work required to furnish and install complete luminaire units of the type specified including wiring to the conduit.

4. **"Relocate (Item)"**, per each.

The Bid item price for "Relocate (Item)" shall include all costs for the work required to remove the item and reinstall the item complete at the new location, including furnishing new hardware if necessary, and cleaning and relamping relocated luminaires.

5. **"Wiring, Street Lighting"**, per lump sum.

The Bid item price for "Wiring, Street Lighting" shall include all costs for the work required to furnish and install wiring for the Street light system from the service point to the luminaire fuseholder, including taps, splices, tape, fuseholder, excess wire for connections, and any other Material necessary for a complete illumination and electrical system.

6. **Other payment information.**

All final service connections of the illumination and electrical Street lighting systems to overhead secondaries, or to secondaries in vaults or handholes will be made by Seattle City Light at no cost to the Contractor.

All costs for furnishing and installing hardware not specifically called out, but required to complete the constructions in Section 8-30 shall be included in the applicable Bid item prices and no separate or additional payment will be made.

Costs for Electrical Safety Observer shall be in accordance with Section 1-05.2(2).

SECTION 8-31 TRAFFIC SIGNAL SYSTEM**8-31.1 DESCRIPTION****8-31.1(1) GENERAL**

This Work shall consist of furnishing and installing a complete and functional *Traffic* control system consisting of controller assembly, signals, miscellaneous *Traffic* devices, and appurtenances in accordance with the Contract.

The Contractor shall become thoroughly familiar with the electrical environment within the Project Site and with the relevant Work.

All final signal system service connections to secondary overhead / underground will be made by Seattle City Light.

If, for any reason, vehicular or pedestrian signal(s) fail to function properly, the Contractor shall immediately call for an off duty Uniformed Peace Officer to control the intersection. The Contractor shall also immediately notify the Engineer and the Owner's Signal Maintenance Office (206-386-1206) of the nature of the malfunction. The Contractor shall immediately undertake the necessary repairs. The Engineer may require the Work to be done by Owner forces.

8-31.1(2) ELECTRICAL AND ELECTRONIC WORDS AND PHRASES

See Section 1-01.3.

8-31.1(3) APPLICABLE ELECTRICAL CODES

See Section 8-30.1(2).

8-31.1(4) SUBMITTALS AND REFERENCE MATERIALS**8-31.1(4)A SIGNAL SHOP DRAWINGS**

The Contractor shall submit Shop Drawings including catalog cuts in accordance with Section 1-05.3 for the following:

- | | | |
|---|---------------------------|----------------|
| 1. Signal Heads and Mounting Assemblies | | |
| 2. Cable and Wire | | |
| a. Wire Connections | b. Fuse Kits | c. Splice Kits |
| 3. Pole Line Hardware | | |
| 4. Interior Illuminated Signs | | |
| 5. Miscellaneous | | |
| a. Telephone Station Protector | c. Pedestrian Push Button | |
| b. Aerial Terminal Compartments | d. Ground Rods | |

6. Detector Loops
 - a. loop sealant
 - b. wire

The Contractor shall submit three prints and one transparency of the "as built" wiring diagrams to the Engineer for each signalized intersection at least 3 working Days prior to requesting the Engineer's approval for turn-on or cut-over. All prints and transparencies shall be reasonably readable.

Transparencies shall be of a quality providing clear and readable reproductions.

8-31.1(4)B SAMPLES

The Contractor shall submit a sample to the Engineer for approval of the type of vehicle and pedestrian signal heads, illuminated signs, and mounting hardware used. Approved samples will be retained for future comparison for the remaining Equipment to be installed.

8-31.1(5) CONTROLLER ASSEMBLY TESTING REQUIREMENTS

8-31.1(5)A RESERVED

8-31.1(5)B RESERVED

8-31.1(5)C RESERVED

8-31.1(5)D FIELD TESTING

The Contractor shall make the following tests on all new electrical circuits. Test Equipment shall be calibrated as recommended by the test Equipment manufacturer.

1. Test for continuity of each circuit.
2. Test for grounds in each circuit which consists of the physical examination of the installation to ensure that all required ground jumpers, devices and appurtenances do exist and are mechanically firm, meeting the requirements of Article 250 of the National Electrical Code.
3. A megger test on each circuit between the conductor and ground with all switchboards, panel boards, fuse holders, switches, receptacles and over current devices in place and all readings recorded. The megger test shall be performed with all wiring installed but connections not made to controller, conflict monitor, load switches, or other plug connected accessories. The Contractor shall submit to the Engineer with 3 copies of the test results identifying observed readings with their respective circuits at least 3 Working Days prior to any checkout of the installation to be turned on or cut over. One copy shall be filed in the controller cabinet.

The insulation resistance on all electrical circuits whose nominal voltage is between 115 volts and 600 volts, other than direct burial cable, shall not be less than 6 megohms between the conductor and ground on circuits with total single conductor lengths of more than 2,500 feet, nor less than 8 megohms for circuits with single conductor length 2,500 feet or less.

For circuits below 115 volts nominal and all direct burial circuits, the insulation resistance shall not be less than 2 megohms to ground, and for loop wire not less than 10 megohms.

Any change in the above stated minimum readings shall require written approval by the Engineer.

Only those factors based on dielectric properties of conductor insulation, splicing insulations, terminal strips, etc., will be cause for consideration of variance.

4. A functional test (intersection check-out) in which it is demonstrated that each and every part of the system functions as specified or intended herein. The functional test will be performed after all field connections to the controller cabinet have been made.

Any fault in any Material or in any part of the installation revealed by these tests shall be justification for the Material to be replaced or for the part to be repaired by the Contractor in a manner approved by the Engineer, and the same test shall be repeated until the system is approved by the Engineer.

8-31.1(6) GUARANTEE

See Section 1-05.10.

8-31.2 MATERIALS

Materials shall meet the requirements of Section 9-32.

All welds on tubular steel shall comply with the requirements of ANSI/AWS D1.1 Section 10 Tubular Structures.

8-31.3 CONSTRUCTION REQUIREMENTS

8-31.3(1) CLEARANCE REQUIREMENTS AND INTERSECTION CHECK-OUT AND TURN-ON PROCEDURES

8-31.3(1)A TRAFFIC CONTROL

The Contractor shall provide an off duty Uniformed Peace Officer at any time a signalized intersection is dark or inoperative, such as during controller change-out, cable installation, signal turn-on or cut-over, or similar circumstances. The Contractor shall have all *Traffic* controls (i.e., pavement markings, channelization, and signing) in place prior to requesting Engineer's approval for turn-on or cut-over.

To maintain safe Traffic conditions, existing signals shall remain in operation until a simultaneous cut-over to new signals can be accomplished.

At the time of turn-on of new signals, temporary advanced warning signs approved by the Engineer shall be installed on all approaches. *These signs shall remain in place for not less than 7 Calendar Days nor more than 21 Calendar Days. All signs shall be highly visible and be placed in convenient and secure locations.*

At the time of cut-over of revised signals having phasing which is different from the old signal operation (i.e., added phase, split phase, etc.) temporary "SIGNAL REVISION" signs shall be placed upstream on all approaches. These signs shall remain in place for not less than 7 nor more than 14 calendar Days. At a cut-over of revised signals having phasing which is the same as the old signal operation, no temporary signing is necessary. *All signs shall be highly visible and placed in convenient and secure locations. See Sections 8-31.3(16), 1-07.23, and 1-10 for Traffic safety and Traffic control.*

8-31.3(1)B CONTROLLER CABINET AND HANDHOLE ACCESS REQUIREMENTS

Access to controller cabinets and handholes shall be provided at all times. Storage of any item on, against, or within 3 feet of any controller cabinet will not be allowed. Controller cabinets shall always have at least 3 feet clear on all sides. Clear and uncluttered access between the controller cabinet and accompanying handhole shall be provided at all times with a minimum access width of 3 feet. Temporary storage of any material on top of or within 2 feet of any handhole will not be allowed.

8-31.3(1)C CONTROLLER ASSEMBLY REPLACEMENT

At each location which requires that an existing controller assembly be replaced by a new one using the existing foundation, the Work shall proceed as follows:

The Contractor shall check and tag all field circuits, and shall provide the Engineer at least 3 Working Days advance notice for de-energizing.

After field circuits have been tagged, the Engineer will de-energize the controller assembly, and disconnect and remove existing controller and auxiliary equipment from the cabinet. The Contractor shall then remove the field wiring, remove the existing controller cabinet, install the new controller cabinet, and connect the field wiring.

At each location selected for modification Work that requires removal or rebuilding of the existing controller cabinet foundation, the Engineer will de-energize the controller cabinet and remove electronic Equipment while the Contractor temporarily relocates the existing cabinet as approved by the Engineer. The cabinet shall be temporarily relocated in such a manner that the intersection operates in its present mode during foundation reconstruction or modification. The Contractor shall protect the controller assembly within the Work area, as approved by the Engineer.

Following foundation reconstruction, the new controller assembly shall be installed on the new or modified foundation.

8-31.3(2) TRAFFIC SIGNAL CONTROLLER ASSEMBLY

8-31.3(2)A GENERAL

The Contractor shall install the controller cabinet. The Engineer will install the controller and associated electronic Equipment.

Auxiliary Equipment added to existing controller cabinets shall be installed as indicated on the Drawings and as specified herein.

Any field modifications shall require the Contractor to submit to the Engineer for approval a modification plan 3 weeks prior to scheduling the Work. The submittal shall include Equipment layout and wiring diagrams detailing the work to be done, as well as the portion of the critical path schedule to be followed. *A description of how the Work affects Traffic and signal operation shall also be submitted at this time, along with information on measures to be taken to minimize adverse impacts on Traffic.*

The Engineer shall be notified 2 Working Days in advance of energizing the unit.

After signing the Owner's functional test report, the Contractor shall pick up the controller cabinet at the Traffic Signal Shop (at 4200 Airport Way South, 206-386-1206, *at least 2 Working Days advance notice is required*) for installation. If the Contractor does not plan to install the controller cabinet immediately, it shall be stored at the Contractor's expense in a dry secure area.

8-31.3(3) SIGNAL HEADS, VEHICLE AND PEDESTRIAN

8-31.3(3)A GENERAL

Signal heads shall not be installed at any intersection earlier than 10 Working Days prior to turn-on or cut-over.

Mounting shall be bracket, mast arm, post top, span wire, or clamshell as indicated on the Drawings. Signals mounted on post tops shall utilize standard 4-inch slipfitters. Bracket-mounted signal heads shall utilize the signal bracket assembly and type of mounting indicated on the Drawings. The bracket assembly shall be installed in line with the pole center line.

Attachments such as visors, backplates or adapters shall conform and readily fasten to existing mounting surfaces without affecting the weatherproofing and light integrity of the signal.

Electrical service shall be neatly formed to the supporting structure with only sufficient slack for wind effect when span wire mounted.

All new vehicular and pedestrian signals shall be temporarily, securely, and completely covered with a 6 mil minimum thickness black, or blue, polyethylene sheeting until the time of turn-on or cut-over.

Alignment of vehicular and pedestrian signal heads and the overall readiness of other *Traffic* control devices and channelization will be approved by the Engineer prior to activating signal locations.

8-31.3(3)B VEHICLE SIGNAL HEADS

The bottom of vehicle signals mounted over roadways, excluding backplates shall have a range of clearance *between 16 feet 6 inch to 19 feet* above roadway grade at the crown of the Roadway. On designated truck and overhead trolley routes, the range of clearance shall be 18 feet to 19 feet. Under no circumstances shall the bottom of the vehicle green section be more than 19 feet above Roadway grade at the crown of the Roadway. Vehicle signals mounted on poles or pedestals shall be 11 to 15 feet above sidewalk grade. Pole plates used for bracket mounted installations shall be of the type that shall fit flush against the pole surface without altering the pole or pole plate.

The signal shall be mounted with standard 1-1/2 inch fittings as a single section or as a multiple section head. The signal section shall be provided with an adjustable connection that permits incremental tilting from zero to at least 10 degrees above or below the horizontal while maintaining a common vertical axis through couplers and mounting. Terminal connection shall permit external adjustment about the mounting axis in 5-degree increments. The signal shall be mountable with ordinary tools and capable of being lamped without tools.

Signal heads located over the roadway shall not be in conflict physically or visually with trolley wires, span wires, electrical wires or any other hardware existing or proposed for the location. A 3-foot edge to edge clearance shall be maintained between signal heads and trolley wires. Span wires and tether lines within 4 feet of trolley lines shall be properly insulated. If it becomes evident that a conflict exists, the Contractor shall immediately notify the Engineer and allow 5 Working Days to resolve the problem.

Balance adjusters shall not be installed when the approach grade is less than 10%.

When balance adjusters are required, the vehicular heads shall be adjusted in the field such that persons standing on the pavement, four times the speed limit in feet back from the stop bar, shall see the brightest image of the red section. Heads shall be plumbed as viewed from the direction in which they face.

Optically programmed type *Traffic* signal heads shall be programmed before *Traffic* signal system turn-on. Programming shall be performed in the presence of the Engineer (note - also a representative of the Traffic Signal Shop) by giving 2 Working Days advance notice.

Vehicle signal heads shall be attached to the mast arm with a signal coupling unit as detailed on *Standard Plan nos. 510a and 510b*. Mounts shall include elevator straight plumbizer units between the red and yellow signal sections, or 90 degree plumbizers.

Vehicle signal heads shall be attached to the span wire by means of a hanger clamp, balance adjuster, and suspension fittings as shown on the Standard Plans. The sag in the span wire after loading shall be within the range of 5 percent to 7 percent of the total span. Span wires shall be attached to the poles such that the signal head mounted at the lowest point on the span does not require a signal height adjuster. The top (red) section of all heads hanging on the same span shall be approximately level when viewed from the approach direction.

For optically programmed signals which are span wire mounted, a tether cable with connections and hardware as recommended by the signal head manufacturer shall be used to provide and maintain proper optical visibility of all indications. The tether cable clamps used shall be designed to release under severe wind loads and impact. The tether cable shall be insulated, bright yellow, and shall be installed a minimum 18 feet above roadway grade.

8-31.3(3)C PEDESTRIAN SIGNAL HEADS

Pedestrian signal heads shall be aligned to focus on the center of the far end of the crosswalk which it is associated with and at a point 5 feet above the opposing sidewalk.

Multiple pedestrian signal heads mounted on a pedestal shall be stagger mounted so that the distance to the bottom of the lower housing is 8 feet above the sidewalk, and the distance to the bottom of the upper housing is 9 feet 6 inches above the sidewalk.

The Contractor shall use a "Clamshell" type mounting assembly for pedestrian signals.

Pedestrian signal heads mounted on the same pole (not pedestal) shall be installed so that the bottom of the housing of each head is a minimum 8 feet to a maximum 9 feet 6 inch above sidewalk grade. On poles where the signal housings interfere with each other, stagger mounting shall be required as indicated on the Standard Plans.

8-31.3(4) PEDESTRIAN PUSH BUTTON ASSEMBLY

The push button assembly shall be located on the side of the pole as shown on the Drawings. The mounting height shall be *as indicated on Standard Plan nos. 521 and 523*.

8-31.3(5) DETECTOR LOOPS**8-31.3(5)A LOOP WIRE**

Vehicle loop detectors indicated on the Drawings are located schematically and actual loop detector locations will be verified by the Engineer prior to sawcut or installation. The Contractor shall mark out proposed detector loops on the roadway at least 3 working Days before any sawcut or installation occurs. The location of stop bar pavement marking shall be obtained by the Contractor prior to sawcut or loop detector installation. In general, loop locations shall be located behind existing or proposed stop bar pavement marking, and shall not be located where pavement dowel or tie bars or metal supports within the pavement are located. Loops located within or beyond the stop bar pavement marking will not be allowed. The Contractor shall not begin sawcutting pavement until loop locations have been approved by the Engineer. When parallel to a pavement joint or edge, the sawcut shall be at least 1 foot away from the edge or joint. *All saw cuts shall be cleaned of all debris.*

The Contractor shall sawcut pavement to a depth *that* provides a minimum 1 inch cover between the top of loop wire and pavement surface.

One single continuous length of loop wire shall be used to form a loop with the number of turns indicated on the loop schedule on the Drawings. The wire shall be placed by tamping it into the saw cut with a blunt wooden stick, taking care not to damage the insulation. To reduce abrasion of the insulation, the Contractor shall sawcut all corners at least once to reduce the corner angle. This corner angle shall then be filed or smoothed acceptably free of sharp edges.

The sawcut in concrete shall be filled with a quick-drying high strength Highway concrete patching Material. *The Contractor shall submit to the Engineer at least 3 Working Days in advance, a catalog cut describing the patch Material properties including strength and time to develop strength characteristics.*

In asphalt installations, the loop wire shall be sealed with an asphaltic sealant approved by the Engineer. Sealing shall not be performed when the pavement is damp.

When placing loops across joints or cracks in pavement, the portion of wires across the joint or crack shall be protected by placing it in tubing as indicated on the Standard Plans. The tubing shall be sliced open to insert the wire in the tubing and then placed across the joint or crack extending a minimum six inches each side of the joint or crack.

Loop wire, from the loop to the lead-in splice, shall be twisted a minimum of 3 turns per foot. Care shall be taken so that the twists are uniform.

A minimum of 60 inches of loop wire shall be brought into the handhole and spliced to the lead-in cable with a crimped soldered, waterproof splice.

8-31.3(5)B DETECTOR LOOP LEAD-IN CABLE

The Contractor shall sawcut pavement to a depth which provides a minimum 1 inch cover between the top of loop wire and pavement surface.

Lead in cable shall be one continuous length from the splice at the handhole to the termination point in the controller cabinet.

The cable shield and drain wire shall be grounded at the system ground only at the controller cabinet and shall be continuous and insulated.

Each loop lead-in wire shall have a permanent cloth or plastic tag with the label number shown on the loop detector wiring chart specified on the Drawings. These tags shall be placed at handhole splice and controller cabinet terminations.

As-built drawings: *Before Turn-on/Cut-over, the Contractor shall provide the Engineer as-built drawings diagramming the complete loop detector system. After Turn-on/Cut-over has been accepted by the Engineer, a dated as-built drawing, provided by the Contractor, of the complete loop system indicating their size, direction, lane location, inductance reading and identifying number assigned shall be installed in the controller cabinet. See Sections 8-31.3(5)C, 8-03.3(5)E, 8-31.3(16), and 1-05.3(4).*

8-31.3(5)C INDUCTANCE TESTING AT THE HANDHOLE

Before splicing the loop wire to the loop lead-in cable, an inductance test shall be performed by the Engineer to ensure the inductance is within the acceptable range of plus or minus 15 percent of the calculated inductance. If the inductance does not fall within the acceptable range, the Contractor shall take necessary corrective measures until the desired readings are obtained or as approved by the Engineer.

As-built drawings: *Before Turn-on/Cut-over, inductance readings shall be recorded on the as-built drawings showing the reading for each loop. After Turn-on/Cut-over acceptance by the Engineer, the as-built record in the controller cabinet shall reflect the final inductance readings. See Sections 8-31.3(5)B, 8-03.3(5)E, 8-31.3(16), and 1-05.3(4).*

8-31.3(5)D LOOP CONTINUITY TESTING

Before cut-in/Turn-over, the completed loop and lead-in configuration after splicing shall be checked for continuity by the Contractor, using a tester that does not exceed the voltage rating of the lead-in and loop wires.

The Contractor shall also perform a megger test on the loop and lead-in configuration to make certain that the resistance to ground is 10 megohms or greater. If resistance to ground prior to placing the sealant is less than 10 megohms, all splices and wires should be checked for insulation damage. *Corrective measures shall be taken until an acceptable resistance is obtained.* After the slot has been sealed, the Contractor shall perform the resistance and continuity tests again. *If the continuity and resistance tests do not meet the above-mentioned requirements, the Contractor shall take corrective measures until readings acceptable to the Engineer are obtained.*

8-31.3(5)E INDUCTANCE TESTING AT THE CONTROL CABINET

After loop wire and lead-in cable splices have been made, and the continuity test has been completed, the Engineer shall test the inductance of the loop and loop lead-in cable at the controller cabinet. The inductance *shall* be within the acceptable range of plus or minus 15 percent of the calculated inductance. *If the inductance does not fall within the acceptable range, the Contractor shall take corrective measures until acceptable readings are obtained.*

As-built drawings: *Final readings shall be recorded on the as-built drawings of the total inductance for each of the loops plus lead-in circuits. See Sections 8-31.3(5)B, 8-31.3(5)C, 8-31.3(16), and 1-05.3(4).*

8-31.3(5)F ENCAPSULATED DETECTOR LOOP

The requirements of 8-31.3(5), excluding Section 8-31.3(5)A, shall apply to encapsulated detector loops. Encapsulated detector loops shall be installed and tested prior to the pavement being installed.

The Contractor shall mark out proposed loop detector locations for the Engineer's approval at least 2 Working Days prior to installation. The loop detector location coordination requirements of Section 8-31.3(5)A shall be followed.

Loop and home-run locations referenced to the face of the nearest curb shall be noted on the as-built drawings.

The Contractor shall install the loop wire and conduit within the base course of the pavement system. Neither the loop nor any of its components shall be installed within concrete pavement Material. *A minimum of 60-inches of loop wire shall be brought into the handhole and spliced to the lead-in cable with a crimped/soldered waterproof splice.*

Before paving operations begin, the Engineer will conduct an inductance test per Section 8-31.3(5)C. An inductance test will again be performed after the pavement has been installed and before turn-on or cut-over. Also, the Contractor shall conduct the tests required by Section 8-31.3(5)D after the pavement has been installed and before turn-on or cut-over. Such tests shall be performed in the presence of the Engineer.

8-31.3(6) OVERHEAD INTERIOR ILLUMINATED SIGN

Interior illuminated signs shall be temporarily covered completely with a 6 mil *minimum thickness* opaque polyethylene sheeting until the sign is ready to be energized and the Engineer authorizes the Contractor to remove the sheeting.

The sign shall be mounted as indicated on the Standard Plans *unless indicated otherwise in Contract*. The sign shall be mountable and capable of being serviced with common tools. *The clearance distance to the bottom of the sign at the lowest point on the span to the Roadway shall be a minimum of 16-1/2 feet and a maximum of 19 feet. On designated truck routes, this clearance shall be a minimum 18 feet.*

Signs shall be plumb.

8-31.3(7) RESERVED

8-31.3(8) INTERCONNECT CABLE

8-31.3(8)A GENERAL

The Contractor shall match the sag as closely as possible with wires already on poles to ensure minimal movement in windstorms and adjacent wire conflict.

All cable pulled through underground ducts shall be lubricated with an approved cable pulling compound.

The Contractor shall use grip or "come-along" to hold on to the jacketed messenger when pulling and tensioning. Pulling and tensioning shall be done in such manner as to not damage the jacket. When separating the messenger from the jacketed conductor assembly for dead-ending or splicing, the web shall be split in the middle. Cable with damaged jackets will be rejected and promptly replaced by the Contractor at no expense to the Owner.

At corners and run ends, the messenger strand shall be dead-ended with either automatic strand vises or preformed guy grip dead-end. When dead-ending with strand vises, the Contractor shall cut the strand and remove the jacket from the steel strand, exposing enough strand so that the ends of the strand coming through the chuck of both strand vises can be overlapped and bonded together to form a continuous ground. A 1-bolt guy clamp shall be used to bond the strand ends together.

Interconnect cable shall not be spliced. The cable shall be a continuous run between the terminal strip of one controller to the terminal strip of the next controller. The messenger wire shall be removed from aerial figure 8 cable in pole risers and conduit.

The shield of all cables entering an aerial terminal compartment shall be terminated on a common terminal. The shield shall be connected to the terminal strip of the controller at the start of a system and then connected only at alternate controls along the route of the system.

The installation of controllers and the connection to the energized interconnect cable shall be done starting at the master control point and going to the end of the system. When controllers are to be connected into new or existing systems, care shall be taken not to disrupt the integrity of the entire system. *A plan of order for converting from an old to a new system shall be submitted for approval by the Engineer at least 10 Working Days in advance.*

An extra six (6) feet of interconnect cable shall be coiled in the nearest handhole to the controller cabinet. After the cable has been pulled into the controller cabinet, the outside jacket shall be stripped back 3-feet. All exposed wiring shall have the gel removed from each wire individually. The Jacket end shall be sealed to prevent the gel from leaking out of the cable. Sealing shall be done by applying a small portion of duct seal, well pressed between the wires and jacket and then firmly taped with 4-6 wraps of friction type extending two (2) inches from each side of the jacket end to hold the seal in place. After cleaning and sealing, the exposed length of wiring shall be retwisted as a pair with the original mate. An approved shield grounding connector shall be used to ground the shielding.

Interconnect cable in conduit shall be installed in accordance with Section 8-30.3(5).

8-31.3(8)B TELEPHONE INTERCONNECT CONNECTION

The Contractor shall notify the Engineer at least 4 weeks, but not more than 6 weeks, in advance of the expected turn-on in order that the Engineer can request the telephone service provider to install the two-pair interconnect drop to the telephone station protector.

The Contractor shall have completed the telephone station protector, with associated wiring to the controller, before the phone connection can be installed and tested when the request is made.

8-31.3(9) SIGNAL WIRING**8-31.3(9)A CONDUCTOR INSTALLATION**

The Contractor shall be responsible for making all circuits fully functional after pulling in new cables.

Cable and wire which is damaged in pulling shall be promptly replaced with new cable at the sole expense of the Contractor.

When conductors and cables are being installed, care shall be exercised not to exceed tension limitations recommended by the manufacturer. Conductors may be pulled directly by hand. However, if conductors are pulled by any mechanical means, a dynamometer with drop-needle hand shall be used on every mechanical pull.

On mechanical pulls, sufficient insulation shall be stripped off the conductor to form a pulling eye and then firmly taped before pulling; or a cable grip shall be used. The pulling force applied directly to the conductor, when pulling eyes are used or when the conductor is formed into a loop, shall be limited to 0.008 pound per circular Mil area of copper conductor but shall not exceed the recommended limits of the conductor's manufacturer. When a cable grip is applied over nonmetallic sheathed cables, the maximum pulling force shall be limited to 1,000 pounds, provided this is not in excess of the force as calculated above.

To limit the side wall pressure at bends in duct and conduit runs, the pulling force in pounds shall not exceed 100 times the radius of the bend in feet or the manufacturer's recommendation, whichever is less. Adequate lubrication of the proper type to reduce friction in conduit and duct pulls shall be utilized. Lubricant shall be of a non-hardening type approved by the Engineer.

In existing conduits where new cable is to be installed which contain existing *Traffic* and *Street* light wiring as noted on the Drawings, the Contractor shall protect existing wiring from damage due to pulling new cable. Cable pulling compound shall be used to minimize cable pulling tensions and adverse effects on existing insulation, jackets and shields.

Enough cable shall be pulled into controller cabinets to allow approximately 4 feet of cable to be stripped and coiled around the bottom of the cabinet before connections are made.

Cable routings on span wire shall be securely attached to the span wire by means of 4-6 wraps of friction tape spaced no more than 18 inches apart. Drip loops shall be left at the point of entrance to span mounted signal heads and steel pole conduit entrance fittings to allow moisture to drip from the cable rather than run down the cable into entrances. Where the drip loop from the pole outlet to the span wire exceeds 18 inches, the cable shall be secured to the pole to give a neat appearance.

All electrical cable for *Traffic* signal facilities passing through handholes, junction boxes, conduit bodies, vaults and manholes shall be properly identified. Each cable shall be identified as to its function by using 3 wraps of colored plastic tape as follows:

Cable Function	Tape Color
Vehicular Signal Circuits	Red
Detector Circuits	Yellow
Pedestrian Signal Circuits	Green
Push Button Circuits	Brown
Interconnect	White
Telephone Circuit	Two White (White-White)
Service	Orange
Fire Pre-empt	Blue (light)

Colored tape identification shall also apply to cables spliced in pole and pedestal bases and aerial splices. Each cable shall be identified with the appropriate colored tape within 6 inches of a splice. Cable in handholes, junction boxes and conduit bodies shall be appropriately marked near the center of the enclosed section of cable. Cable passing through Seattle City Light handholes, manholes and vaults shall be identified with a permanent waterproof marker secured to the cable. The cable marker shall indicate "SED SERVICE" for *Traffic* signal service cable, "SL SERVICE" for *Street* lighting cable, or "SED SIGNAL" for all other *Traffic* signal cable usage.

Work in manholes and vaults shall be done in accordance with the National Electric Safety Code and Seattle City Light Standards. Cable being installed in manholes and vaults with existing power cable should be racked on the wall opposite the power cable. If cable must be racked on the same wall with power cable, it shall be mounted above the power cable, maintaining a 6-inch minimum separation. Every effort should be made to minimize any negative impact of power cable noise and transients upon the new communications cable, while adhering to all safety regulations. See Section 1-07.28 item 6 regarding notifications required for work in Seattle City Light structures. In handholes, all cables and conductors shall be orderly to provide easy recognition and quick access.

Requirements for cable bending, training and racking shall be in accordance with Seattle City Light Construction Standard U4-2.8. For convenience, several of the frequently needed requirements are:

1. Rack opposite the primary.
2. Maintain proper cable separation.
3. Signal cable should be above all other existing cable.
4. Elevation changes shall be made behind other cable.

5. Use existing rack, if available or use stud gun for installation to wall at 4-foot spacing, with 2-foot spacing near cable entrances.
6. NEMA boxes should be on an end wall, 2-feet from the ceiling and be visible from the manhole opening.

Care shall be exercised in working near and within any Seattle City Light vaults. Voltages present are as high as 26,000 volts, and the vault wiring will not be de-energized while the Contractor is working. Seattle City Light safety and Electrical Safety Observer standards shall be adhered to while working in vaults or in the vicinity of the electrical distribution system. See Sections 1-05.2(2), 1-07.1(2), and 1-07.28 item 6.

8-31.3(9)B SPLICES

Signal cable shall be spliced only in poles, pedestal bases, or overhead within 2 feet of the poles. Aerial splices shall be covered by reverse wrapping of the first layer with electrician insulating tape, then a built-up rounded end of electrical tape, then a minimum of 2 layers forward with electrician tape.

At locations where existing signal cables are being utilized, the *Traffic* signal cables shall be spliced in pole or pedestal bases and each individual conductor shall be insulated and the entire splice shall be waterproofed.

Each individual splice or termination of extra leads shall be insulated, taped and made waterproof.

Loop wire shall not be spliced, except with the loop lead-in wire within the handhole.

Service cable or master cable shall not be spliced except as indicated on the Drawings.

8-31.3(9)C TERMINATIONS

Except at a splice, conductors shall be terminated on a terminal strip or push-on connectors at the signal Equipment which it is serving. Only terminal strips with screw-type pressure binding posts shall be used. Stranded conductors shall use compression-type pressure fittings at the terminal strip. Single solid conductors shall attach directly to the screw post; otherwise compression - type pressure fittings shall be used when more than one conductor is attached.

All electrical terminations shall be tightened to their prescribed torque value.

All terminals shall be marked with field wiring numbers printed on back or front-mounted marking strips.

8-31.3(9)D PEDESTRIAN PUSH BUTTON CABLE

The cable shield shall be grounded to the system ground only at the controller end. The cable shield between cabinet and splice shall be continuous throughout intermediate junction boxes and shall be insulated to prevent grounding in any junction box or in any conduit.

8-31.3(9)E ELECTRICAL SERVICE CONNECTIONS

The Contractor shall furnish and install Equipment and wiring for 2 parallel 120 volts, 60 Hz AC electrical services. The electrical service cable shall be installed as indicated on the Drawings.

All final service connections of signal system to overhead secondaries or to secondaries in vaults or handholes will be made by Seattle City Light. The Contractor shall arrange a schedule with the Engineer for service connections at the preconstruction conference.

8-31.3(10) GROUNDING AND BONDING

All metallic appurtenances containing electrical conductors, including cabinets, metallic conduit, metal poles, pedestals, junction boxes, and handhole frames and lids shall be made mechanically and electrically secure by forming a continuous system which shall be effectively grounded.

Where conduit systems are employed, all metallic appurtenances shall be electrically bonded as required by Article 250-95 of the NEC.

The Equipment grounding conductor shall in all cases be sized consistent with Table 250-95 of the NEC. All proportional adjustments in grounding conductor capacities shall be considered as accomplished by the installation of a ground rod at each handhole. The metal ring on the handhole and its metal cover shall also be grounded locally per NEC requirements.

Equipment grounding conductors, if insulated, shall employ insulation rated at 60 °C or higher and shall be chemically compatible to other insulations contained within the system.

Identification of the Equipment grounding conductor shall conform to all NEC requirements.

Grounding of conduit and neutral at the service point shall be as required under the NEC.

Service ground and neutral shall kept isolated from the logic ground circuits in the controller cabinet.

A ground wire shall bond all system ground rods. A ground clamp shall be used to secure the ground wire to the ground rod. The neutral bus on the service switch shall be connected to the closest ground rod.

8-31.3(11) POLE LINE HARDWARE INSTALLATION

Span wire portions that are directly above METRO trolley wires shall be covered with plastic cable guard. The cable guard shall extend a minimum of four (4) feet beyond each side of the trolley wire track. The cable guard will be furnished by the Owner. *The Contractor shall give the Engineer at least 10 Working Days advance notice prior to installation. See Section 1-07.28 item 11 regarding notifications required for coordination of Work with METRO trolley lines.*

Span wire shall be secured to steel strain poles by means of pole bands, and to timber poles by means of single strand guy eye bolts. Span wire sag shall be 5 to 7 percent of the total span. Pole bands and eye bolts shall be installed as detailed on the Standard Plans.

Span wire shall be secured to eye bolts or strain clamps at poles by use of self-locking cable clamp type dead-ending devices. Span wire shall be secured to bull rings and anchors by the use of cable guy wrap and guy thimbles. Span wire shall be secured to strain insulators by the use of cable guy wraps.

Strain insulators shall be installed on all spans and down guys at a distance of 9 feet from the face of wood poles, and 3 feet from the face of steel poles.

Tether wire shall be mounted a minimum of 18 feet above the Roadway.

On steel poles, no lag or through bolts shall be used.

8-31.3(12) RELOCATING EQUIPMENT

When existing Equipment is to be relocated, the Contractor shall furnish and install all necessary new Materials and Equipment (including all hardware) required to install the salvaged Equipment in the new installation. Any new hardware required to complete the installation shall be of the same quality and type as hardware required in these Specifications for all other new Work.

All *Traffic* signals, flashing beacons, and illuminated signs to be relocated shall be cleaned and relamped.

8-31.3(13) REMOVAL AND SALVAGE OF EXISTING ELECTRICAL EQUIPMENT

Refer to Section 2-02.3(3)G and 2-02.3(7)C.

8-31.3(14) OWNER FURNISHED EQUIPMENT AND MATERIALS

The Contractor shall pickup equipment and Material, as specified and at pickup locations indicated in the Contract, and install such as indicated on the Drawings.

8-31.3(15) CHECK-OUT PROCEDURE

The Contractor shall arrange a schedule with the Engineer at least 2 Working Days in advance for a complete intersection check-out after having completed the installation of the controller cabinet, all signal and illuminated sign Equipment, pedestrian signal activators, vehicle detection, interconnect cable system and all the associated wiring and connections as called for *on the Drawings*. The Contractor shall be present and assist with the check-out by energizing each field circuit and assisting as necessary to verify completeness of the installation except for the controller unit and auxiliary units of the controller assembly. If the intersection is found to be incomplete or inadequate, the Contractor will be notified of the deficiencies to be corrected.

8-31.3(16) TURN-ON/CUT-OVER PROCEDURE

See Section 8-31.3(1)A. Upon *acceptable* check-out of an intersection, the Contractor, after conferring with the Engineer, shall arrange a schedule for cut-over from the old signals or a turn-on of a new installation. A request for "turn-on" of a new signalized intersection or "cut-over" modifications to existing signalized intersection shall be submitted in writing to the Engineer at least 5 Working Days prior to the proposed date of an existing signal cut-over, and 5 Working Days prior to the proposed date of a new signal turn-on.. The Engineer will respond to the Contractor within 5 Working Days of receipt of request for cut-over or turn-over.

As-built drawings: The Contractor shall submit an as-built wiring diagram to the Engineer at checkout. See Sections 8-31.3(5)B, 8-31.3(5)C, 8-31.3(5)E, and 1-05.3(4). See Section 8-31.3(17) for final as-built drawing requirements.

Turn-ons and cut-overs will not be permitted on Friday, Saturday, Sunday, Monday, Holidays or a Day before a Holiday. Only one turn-on or cut-over will normally be permitted in a single Day. *Turn-on or cut-over Work shall be scheduled and completed between the hours of 9:00 AM and 2:30 PM.*

The Owner will deliver to the *Project Site* and plug into the controller cabinet, the controller unit and the auxiliary units. The signal timing for the controller unit will be done by the Owner. The Contractor shall not energize the signals until the Engineer is on site and has authorized the Contractor to proceed. To maintain safe *Traffic* conditions, existing signals shall remain in operation until a simultaneous cut-over to the signal can be accomplished, unless an alternate procedure is approved in writing by the Engineer. New signals shall not obscure existing *Traffic* controls.

The Contractor shall be present and shall be prepared at such turn-on time, with Materials and tools necessary to correct any malfunctions which may occur. Turn-on shall not take place if any subsequent Work necessitates turning off the signal system.

All new vehicular and pedestrian signals and illuminated signs shall be temporarily covered (sacked) completely with a 6 mil opaque polyethylene sheeting until the new signals are ready to be energized. A small diameter hole (i.e., 1 inch) shall be cut into the opaque plastic cover in front of each vehicular signal lens and a 1 inch by 3 inch slot in front of each pedestrian signal lens to allow for a visual check of indications during performance testing.

Immediately after turn-on or cut-over, all existing vehicular and pedestrian signals that have been deactivated shall be sacked or removed. The old signal heads shall not obscure the new *Traffic* controls at any time.

8-31.3(17) FINAL INSPECTION AND AS-BUILT DRAWINGS

See Section 1-05.11

As soon as practicable after completion of all signal and related Work, the Contractor shall submit to the Engineer for approval, as-built wiring drawings indicating revised field wiring and revised controller assembly wiring. Final as-built wiring diagrams to be placed in controller cabinet(s) shall be in-place one Working Day after acceptance of Turn-on/Cut-over. See Sections 8-31.3(5)B, 8-31.3(5)C, 8-31.3(5)E, 8-31.3(16), and 1-05.3(4).

8-31.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for "Signal Wiring, (Location)" will be by lump sum for each intersection.

Measurement for "Detector Loop, (Size)" and for "Detector Loop, Encapsulated, (Size)" will be by each complete installation.

8-31.5 PAYMENT

Compensation for the cost necessary to complete the Work described in Section 8-31 will be at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Traffic Signal Controller Cabinet, (Description)"**, per each.

The Bid item price for "Traffic Signal Controller Cabinet, (Description)" shall include all costs for the work required to install the Owner furnished cabinet complete on the foundation and make all field terminal connections with the cabinet.

2. **"Signal Head, (Type) (Description)"**, per each.

The Bid item price for "Signal Head, (Type) (Description)" shall include all costs for the work required to furnish and install the signal head complete, including all mounting hardware for the mounting specified, installation, alignment, testing; and when specified, bimodal fiber optic arrow lens, louvers, backplates, and programming as may be required.

3. **"Pedestrian Push Button Assembly"**, per each.

The Bid item price for "Pedestrian Push Button Assembly" shall include all costs for the work required to furnish and install the pedestrian push button assembly complete, including the button and housing, 1 or 2 directional signs as specified, and required mounting hardware as indicated on the Standard Plans. Payment for pedestrian push button posts and foundations will be made in accordance with Section 8-32.5.

4. **"Detector Loop, (Size)"**, per each.

5. **"Detector Loop, Encapsulated, (Size)"**, per each.

The Bid item price for "Detector Loop, (Size)" and for "Detector Loop, Encapsulated, (Size)" shall include all costs for the work required to saw cut the pavement and furnish and install the loop detector wire and conduit complete to the first handhole from the loop, including pavement filler, splices, hardware, and restoration of the pavement surface.

6. **"Sign, Interior Illuminated, (Size)"**, per each.

The Bid item price for "Sign, Interior, Illuminated (Size)" shall include all costs for the work required to furnish and install the interior illuminated sign complete, including all mounting hardware and sign wiring.

7. **"Sign, Crosswalk, Illuminated"**, per each.

The Bid item price for "Sign, Crosswalk, Illuminated" shall include all costs for the work required to furnish and install the illuminated crosswalk signal complete, including all mounting hardware, photoelectric cell installed on a photoelectric control mounting bracket, service wiring, and sign wiring.

8. **"Interconnect Cable, (Type)"**, per linear foot.

The Bid item price for "Interconnect Cable, (Type)" shall include all costs for the work required to furnish and install the cable in conduits or on poles; and shall include all hardware, taps and splices for a complete, interconnected system.

9. **"Aerial Terminal Compartment"**, per each.

The Bid item price for "Aerial Terminal Compartment" shall include all costs for the work required to furnish and install the complete compartment including mounting hardware and sealing.

10. **"Signal Wiring, (Location)"**, per lump sum.

The Bid item price for "Signal Wiring (Location)" shall include all costs for the work required to furnish and install complete signal wiring at the location including signal lead wiring, push-button wiring, sign (attached to signal) wiring, service wiring, and loop lead-in cable. Payment for interconnect cable wiring will be by the Bid item "Interconnect Cable". Payment for internal controller wiring will be by the Bid item "Traffic Signal Controller".

11. **"Span Wire"**, per linear foot.

12. **"Span Wire, Catenary"**, per linear foot.

The Bid item price for "Span Wire" and for "Span Wire, Catenary", shall include all costs for the work required to furnish and install the spanwire complete, including wire, clamps, insulators and all hardware.

13. **"Relocate (Item)"**, per each.

14. **"Relocate (Item)"**, per linear foot.

15. **"Relocate (Item)"**, per lump sum.

The Bid item price for "Relocate (Item)" shall include all costs for the work required to remove and reinstall the item complete, including hardware and rehabilitating signals and signs as required.

16. **Other payment information.**

Existing Materials required to be relocated and found to be unacceptable by the Engineer shall be replaced by new Material and will be addressed as extra Work per Section 1-04.4.

Payment for providing an off duty Uniformed Peace Officer will be in accordance with Section 1-10.5.

All final service connections of electrical signal systems to overhead secondaries or to secondary in vaults or handholes will be made by Seattle City Light at no cost to the Contractor.

All costs for furnishing and installing hardware not specifically called out, but required to complete the Work and approved by the Engineer shall be included in the Bid item prices for the applicable Bid items.

See Section 1-05.2(2) regarding payment for Electrical Safety Observer.

SECTION 8-32 POLES, PEDESTALS, AND FOUNDATIONS

8-32.1 DESCRIPTION

8-32.1(1) GENERAL

This Work shall consist of furnishing and installing poles, *bracket* arms, pedestals, posts, mast arms, concrete foundations and back guy assemblies in accordance with these Specifications and Standard Plans. *The Contractor shall become thoroughly familiar with the electrical environment within the Project Site and with the relevant Work.*

8-32.1(2) APPLICABLE ELECTRICAL CODES

See Section 8-30.1(2).

8-32.1(3) POLE AND PEDESTAL SHOP DRAWINGS

The Contractor shall submit Shop Drawings and catalog cuts in accordance with Section 1-05.3 for the following Materials items:

- | | |
|----------------------------------|--------------------------|
| 1. Metal poles and appurtenances | 4. Mast arms |
| 2. Anchor bolts, nuts, washers | 5. Anchor bolt extenders |
| 3. Pedestals | 6. Bracket arms |

All strain pole(s) or Street light only pole(s) or both which deviate from the Drawings will be considered an alternate proposal and requires a submittal to the Engineer for review and approval at least 10 Working Days in advance of ordering the poles. The alternate pole shall meet all requirements of Section 9-33 and the requirements indicated in the Contract. The Contractor accepts all responsibility for any impact the Engineer's decision may have on the Contractor's critical path schedule and accepts any necessary adjustment to the critical path schedule to meet Contract Time at no additional or separate cost to the Owner. This submittal shall be in accordance with Section 1-05.3(2).

All strain poles (Type T,V,X,Z) are pre-approved by the following pole manufacturers:

Manufacturer	Drawing No.	
Union Metal	71035-C20	71035-C21
	71035-C26	71035-C27
NW Signal Supply	NWS2298	NWS2299
Valmont	DB00229	

If the Contractor chooses to buy poles from one of the above pole manufacturers, the Contractor shall submit the following information to the Engineer for *review and approval* prior to ordering the pole:

- Job name
- Pole manufacturer's name
- Drawing number with current revision specified
- Quantity per each
- Pole type (T,V,X or Z)
- Davit or bracket arm, and arm length
- Specify if second cable outlet with orientation, if festoon outlet, and number of guy clamps.
- Equipment delivery time frame

8-32.1(4) ELECTRICAL AND ELECTRONIC WORDS AND PHRASES

See Section 1-01.3.

8-32.2 MATERIALS

Materials shall meet the requirements of the following Sections:

Concrete for foundations	5-05 and 6-02
Poles, Mast Arms Pedestals, Foundations, and Back Guy Assemblies	9-33
Non-Shrink Cement Sand Grout	9-04.3(2)

All welds on tubular steel shall comply with the requirements of ANSI/AWS D1.1 Section 10 Tubular Structures.

8-32.3 CONSTRUCTION REQUIREMENTS

8-32.3(1) POLES

8-32.3(1)A GENERAL

See Section 8-32.3(2)A for foundation concrete mix design requirements.

The Contractor shall lay out pole locations and grades as indicated on the Drawings. *Poles shall be located to provide a minimum of 3 feet clearance measured from the face of the curb to the face of pole.*

Poles shall be handled in loading, unloading and erecting in such a manner that they are not damaged.

Field repair of galvanized surfaces shall be accomplished by coating with a heated zinc alloy solder to a minimum thickness of 3 mils per ASTM A 780.

The Contractor shall repair or replace all rejected poles at no expense to the Owner. Should the Contractor elect to repair the rejected pole, the Contractor shall submit a repair plan at least 5 Working Days in advance to the Engineer for approval.

8-32.3(1)B METAL POLES AND PEDESTALS

Poles shall not be erected before concrete foundations have cured for a minimum 7 Days and have attained a minimum 70% of specified strength.

Strain and mast arm poles shall not be loaded before concrete foundations have:

- 1 cured for a minimum of 14 Days and*
- 2 have reached specified strength.*

If the Contractor elects to use Type III cement (HES cement), the pole may be loaded after 7 Days curing and after reaching specified strength.

Strain poles type V, X, and Z with METRO loading shall not be loaded until the concrete has both attained design strength and has been cured a minimum 28 Days.

The Contractor may request concrete test samples or provide an ASTM accredited testing laboratory approved by the Engineer to sample and test the concrete.

Signal related poles shall not be grouted until after turn-on or cut-over.

Leveling nuts shall be used on all metal poles. *Leveling nuts and washers shall be placed on anchor bolts to allow between 2 and 4 inches of non-shrink grout under the base plate.* Poles shall be placed on the bolts and the leveling nuts and washers. The leveling and locking nuts and washers shall then be adjusted to plumb the pole.

The pole shall be raked before loading such that it is plumb after all loads have been applied. Plumb shall be defined as the condition existing when an imaginary vertical line from the center line of the pole top passes through the center line of the pole base at ground level. A tolerance of ± 0.17 inches per foot of pole height above the ground will be permitted with the exception that in no case shall the pole lean toward the *pavement*. Locking nuts shall be torqued to the manufacturer's recommendations.

After pole anchor bolts and rake have been inspected and approved by the Engineer with loads applied, tape shall be placed around the periphery of the anchor bolts and leveling nuts, then non-shrink cement sand grout shall be placed under the pole to completely fill the void under the base outside the anchor bolts by packing from the bolts and finishing towards the outside. *The non-shrink grout shall be sloped at approximately 60 degrees away from the base plate. There shall be a 1/2 inch drain tube in the non-shrink grout on the lowest side of the base to provide drainage from within the pole or pedestal to the outside (see Standard Plan nos. 524 and 563a).*

Installation of pedestals shall meet the same requirements for installation of metal poles, except raking will not be required.

8-32.3(1)C WOOD POLES

Wood poles shall be set at the depth indicated in the following table:

Recommended Pole Setting Depth		
Length of Pole	Minimum Set Depth	Set Depth in Rock
20	5.0	3.0
25	5.0	3.0
30	5.5	3.5
35	6.0	4.0
40	6.0	4.0

After each wood pole is set in the ground to the specified depth as indicated on the Standard Plans, the space around the pole shall be backfilled with selected earth or sand, free of rocks and other deleterious material, placed in layers approximately 4 inches thick. Each layer shall be moistened and thoroughly compacted.

When wood poles are used as strain poles, the poles shall be raked to be plumb after loading as defined in Section 8-32.3(1)B.

8-32.3(2) FOUNDATIONS

8-32.3(2)A GENERAL

With the exceptions of strain poles types T, V, X, and Z, concrete mix for foundations shall meet the following requirements:

Type Pole or Pedestal	Class Concrete
Strain <i>and</i> Mast Arm Poles	Class AX
Non-Strain Metal Poles	Class 5 (1 ½)
Chief Seattle <i>Light</i> Pole	Class 5 (1 ½)
Metal Street Light Pole	Class 5 (1 ½)
Pedestal	Class 5 (1 ½)
Pedestrian Push Button	Class 5 (1 ½)

Strain pole foundations for pole types T, V, X, and Z shall have air-entrained concrete Class AX per Section 6-02.3.

Foundations shall be augered and constructed against undisturbed soil. Concrete shall be placed against undisturbed earth within a dry hole. Should a dry hole not be maintained, the Contractor shall select a method of concrete placement which does not adversely impact the strength or durability of the concrete as approved by the Engineer. In unstable ground, forms shall be used for the top 18 inches of foundation, and the Contractor shall be prepared to install sonotube or other approved form Material to provide undisturbed concrete placement. Each foundation shall be poured in one continuous pouring operation. Where new excavations are near an existing foundation, the Contractor shall provide temporary support for the existing structure as appropriate.

Anchor bolts shall be set securely in place and held in a vertical position with the specified bolt projection and at the specified bolt circle to match the exact hole pattern of the item to be installed. The tops of the bolts shall all be at the same elevation. A steel template shall be used at the lower end, and a wood or steel template shall be used at the upper end of the anchor bolts, to maintain the correct bolt pattern and spacing until the concrete has set. Anchor bolts shall not be altered in any way after fabrication. Bending of anchor bolts shall be cause for rejection and removal of entire foundation.

Prior to placing concrete, all projecting anchor bolts shall be taped with a corrosion protection tape from a point 6 inches below the top of the foundation to the top of the bolt. Tape shall be in accordance with SCL Material Standard 7367.3 and shall remain permanently in place. Nuts and washers shall be installed over the tape. Immediately after concrete is placed, the location of the anchor bolts shall be checked with a template conforming to the bolt pattern of the bases of the poles. After the concrete is placed, anchor bolts and conduit shall be cleaned and kept free of concrete splatter and mortar.

Concrete shall be float-finished, edged and brushed where necessary. Adjusting anchor bolts to make them fit the hole pattern in the base plate will not be allowed after concrete has begun to set.

8-32.3(2)B CONTROLLER FOUNDATIONS

Anchors, cinch anchors, nut couplers, square washer and bolts shall be installed per Standard Plans, or by an alternate method recommended by the manufacturer. Where the manufacturer recommends installation differing from the Standard Plans, the Contractor shall submit the manufacturer's recommendations to the Engineer for approval at least 5 Working Days in advance. The cinch anchors shall be sized as recommended by the controller manufacturer. A bead of waterproof sealant shall be installed under the lip of the controller cabinet prior to installing the cabinet to prevent moisture penetration.

Tops of the controller foundations shall be level, and shall be 6 to 8 inch above adjacent finished grade.

A 3/4-inch PVC conduit drain shall be installed in all concrete foundations for signal controllers Type II and Type III cabinet foundations to provide drainage from within the cabinet to the outside finished grade.

A 20 foot coil of #4 copper wire shall be installed within the foundation with a 3 foot tail.

8-32.3(2)C POLE, PEDESTAL AND PEDESTRIAN PUSH-BUTTON POST FOUNDATIONS

Anchor bolts shall be supplied by the Contractor on foundation installations unless specified otherwise in the Contract.

Reinforcing steel shall be kept 3 inches clear from surrounding earth within the concrete pole foundation, and shall be set securely in place.

Where the foundation is in, or adjacent to, a proposed sidewalk/paved area, the top of the foundation shall be at or just below the bottom of the adjacent sidewalk or paving Material. The Contractor shall first coat the foundation top with a bond breaker, and then place sidewalk or paving Material over the top of the foundation. Install premolded joint Material in the construction joint where new pavement or sidewalk is placed over and around the foundation.

Where the foundation is in an unpaved area, the top of the foundation shall be 1" above the finished ground level. The top 6 plus inches of foundation concrete shall be formed into a square.

Conduits shall extend 3 inch to 4 inch above the anchor bolts. Anchor bolts shall be installed, or be cut off, with sufficient projection above the foundation to allow 3 to 5 threads above the upper nut. Where inadequate projection is provided, bolt extenders may, if approved by the Engineer, be utilized, or complete removal and replacement of the foundation will be required at no expense to the Owner.

8-32.3(3) BACK GUY ASSEMBLIES

Back guy assemblies for wood poles shall be constructed in accordance with details on the Standard Plans.

All through bolts shall be properly trimmed and treated.

8-32.3(4) RELOCATING EQUIPMENT

When Equipment is to be relocated, the Contractor shall furnish and install all necessary Materials and Equipment including all new hardware required to complete the new installation. Any new hardware required to complete the installation shall be of the same quality and type as hardware required in the Specifications for other new Work.

8-32.3(5) BRACKET ARMS

Mounting point of the bracket on wood poles shall be located as necessary to provide the required mounting height of the luminaire above the pavement. *However, the Engineer may field determine the required mounting height to provide required wire clearances. The Engineer requires a minimum 1 Working Day advance notice.*

Wood pole bracket arms shall be attached by one through bolt and two lag bolts. Through bolts on wood poles shall be cut off so no more than 4 threads nor less than 3 threads are left exposed beyond the captive nut. The exposed end shall be treated with galvanizing repair paint approved by the Engineer. This through bolt shall not be used to mount any other hardware.

8-32.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs herein this Section.

Measurement for davit poles and the attached davit arm will be per each as a combined unit.

8-32.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-32 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Pole, Steel Strain, (Type)"**, per each.
2. **"Pole, Steel Mast Arm"**, per each.

The Bid item price for "Pole, Steel Strain, (Type)" and for "Pole, Steel Mast Arm" shall include all costs for the work required to furnish and install the pole complete, including pole cap, handhole, handhole cover, nut covers, bracket arm flange and bolts, base plate, all necessary hardware, raking, plumbing, and grouting.

3. **"Pole Steel Strain Davit (Type) w/(Length) Arm"**, per each.
4. **"Pole, (Material) Lighting Davit (Length), with (Length) Arm"**, per each.

The Bid item price for "Pole, Steel Strain Davit, (Type) with (Length) Arm" and for "Pole, (Material) Lighting Davit (Length) with (Length) Arm" shall include all costs for the work required to furnish and install the complete pole, pole cap, the extension arm, including handhole, handhole cover, nut covers, steel pole extension tenon, steel pole luminaire tenon, welding, base plate, all necessary hardware, raking, plumbing, and grouting.

5. **"Pole, Steel Lighting (Length)"**, per each.
6. **"Pole, Aluminum Lighting (Length)"**, per each.

The Bid item price for "Pole, Steel Lighting (Length)" and for "Pole, Aluminum Lighting (Length)" shall include all costs for the work required to furnish and install the pole complete, including handhole, handhole cover, and all necessary hardware, raking, plumbing, and grouting.

7. **"Pole, Wood, (Length), (Type), (Class)"**, per each.

The Bid item price for "Pole, Wood (Length), (Type), (Class)" shall include all costs for the work required to furnish and install the wood pole complete, with pole cap, including excavation, backfill, and compaction.

8. **"Mast Arm (Length)"**, per each.

The Bid item price for "Mast Arm, (Length)" shall include all costs for the work required to furnish and install the mast arm complete with all necessary hardware, fittings and end cap.

9. **"Pedestal, Steel, (Length)"**, per each.

The Bid item price for "Pedestal, Steel, (Length)" shall include all costs for the work required to furnish and install the pedestal complete including pipe, cap, base, and all hardware.

10. **"Pedestrian Push-Button Post"**, per each.

The Bid item price for "Pedestrian Push-Button Post" shall include all costs for the work required to furnish and install the post complete including all drilling and tapping, plumbing, steel pipe, pipe cap "meter collar", grout, pipe flange, and all required hardware.

11. **"Foundation, Traffic Signal Controller (Type)"**, per each.
12. **"Foundation, (Use)"**, per each.

The Bid item prices for "Foundation, Traffic Signal Controller (Type)" and for "Foundation, (Use)" shall include all costs for the work required to construct the foundation complete in place including, but not limited to, excavation, excavation support, and furnishing and placing backfill, forming, concrete, reinforcing steel, anchor bolts, ground rods, washers, nuts, nut covers, grout, wire, conduit, and drainage hardware.

13. **"Back Guy Assembly"**, per each.

The Bid item price for "Back Guy Assembly" shall include all costs for the work required to furnish and install the back guy assembly complete including installation of all guy cable, hardware, insulators, pipe, fittings, and anchor.

14. **"Relocate (Item)"**, per each.

The Bid item price for "Relocate (Item)" shall include all costs for the work required to remove and reinstall the item complete including all new hardware and rehabilitation as required.

15. **"Bracket Arm, (Length)",** per each.

The Bid item price for "Bracket Arm, (Length)" shall include all costs for the work required to furnish and install the bracket arm complete including hardware.

16. **Other payment information.**

When installation of a new pole, pedestal, or post disturbs existing surface improvement that remain, the cost of surface restoration shall be included in the Bid item price of the pole, pedestal, or post as appropriate (see Section 1-07.16).

The installation of the pole number plate furnished by Seattle City Light will be considered as incidental to the cost of installing the pole.

If the Contractor proposes an alternate pole which is approved by the Engineer, no change will be made to the Bid item price for the pole specified in the Bid item.

See Section 1-05.2(2) regarding payment for Electrical Safety Observer.

SECTION 8-33 ELECTRICAL CONDUIT AND TRENCHING

8-33.1 DESCRIPTION

8-33.1(1) GENERAL

This Work shall consist of trench excavation, furnishing and installing conduit, conduit, condulets, and handholes for illumination and signal systems as indicated in the Contract in accordance with these Specifications and Standard Plans.

The Contractor shall become thoroughly familiar with the electrical environment within the Project Site and with the relevant Work.

In areas where deteriorated conduits are encountered during trenching, the Contractor shall promptly notify the Engineer who will then determine if sleeving of conduits is required so as to keep backfill from entering the conduit. It is important to preserve conduits whenever economically practical for future use.

8-33.1(2) APPLICABLE ELECTRICAL CODES

See Section 8-30.1(2).

8-33.1(3) ELECTRICAL CONDUIT SHOP DRAWINGS

The Contractor shall submit Shop Drawings and catalog cuts in accordance with Section 1-05.3 for the following items:

- | | |
|--------------------------------|---------------------------------------|
| 1. Conduit and Fittings | 6. Condulets Junction Box |
| 2. Stand-off Brackets | 7. Expansion Fittings |
| 3. Weatherhead | 8. Seals and Sealing Compounds |
| 4. Galvanizing Repair Material | 9. PVC Coatings to be field installed |
| 5. Handholes and handhole lids | 10. Flexible Conduit |

8-33.1(4) ELECTRICAL AND ELECTRONIC WORDS AND PHRASES

See Section 1-01.3.

8-33.2 MATERIAL

Materials shall meet the requirements of the following Sections:

Conduits and Handholes	9-34
Paint	9-08
Non-Shrink Cement Sand Grout	9-04.3(2)

8-33.3 CONSTRUCTION REQUIREMENTS

8-33.3(1) TRENCHING

Excavation required for the installation of conduit, foundations, and other Materials shall be performed in such a manner as to cause the least possible damage to the Streets, sidewalks, and other improvements. Trenches shall not be excavated wider than necessary for the proper installation of the electrical appliances and foundations. Excavated soils shall be placed where the least interference to Traffic and to surface drainage occurs.

Trenching, conduit and other in-common installation, backfilling, and either temporary surfacing or final surfacing as necessary, shall be scheduled on a daily basis and for minimum disturbance to Traffic.

The Contractor shall take all necessary steps to keep excavated native Material deemed suitable b the Engineer from becoming unsuitable. The requirements of Section 2-03 shall apply.

When tunneling under existing pavement or other surface improvement is required for conduit installation, the Contractor shall submit the proposed tunneling process including the Materials and methods for filling any voids created by the tunneling process at least 5 Working Days in advance for the Engineer's approval.

Depth to top of conduit, or depth of cover, shall be as follows unless specified otherwise in the Contract:

Location of Conduit	Depth of Cover
<i>Under Railroad</i>	<i>48 inches below bottom of railroad ties</i>
<i>Under Asphalt & Concrete Pavement and any Roadway</i>	<i>36 inches</i>
<i>All Other Locations</i>	<i>18 inches</i>

The bottom of the trench for all conduit shall be free of abrupt change of grade or alignment, and be free of objects and materials which could cause damage to conduit, conduit coating, or excessive bending of the conduit. The first 6 inches of backfill shall be free of rock, gravel, or other deleterious objects and materials 1 inch or larger. The Engineer shall approve all conduit installations prior to backfilling the trench.

Trench backfill shall be compacted to 95 percent in accordance with Section 2-03.3(14)E. The first loose lift of backfill over the conduit shall be 8 to 12 inches.

Excavations over 4 feet deep are subject to the provisions of Section 7-17.3(1)A7a, Trench Safety Systems.

8-33.3(2) CONDUIT INSTALLATION

8-33.3(2)A GENERAL

Conduit shall be installed as indicated on the Drawings. When installing conduit under existing pavement or sidewalks, removal shall meet the requirements of Section 2-02. Pavement restoration shall conform with the requirements of Sections 5-04 and 5-05 as applicable. Sidewalk restoration shall comply with Section 8-14. Conduit and fittings within drainage and sanitary Structures and Sewer pump station wet wells shall be considered to be in a Class I environment and all construction shall be in compliance with Article 501 of N.E.C.

Conduit shall be installed in the number, type, size and location indicated on the Drawings.

As-built drawings: For conduit runs that deviate from the location indicated on the Drawings or on Shop Drawings reviewed by the Engineer, and are to be buried in concrete Structures such as floor slabs, retaining walls, abutments, or bridge Superstructures, the Contractor shall be required to submit an as-built drawing showing the actual locations of all roughed-in conduit to the Engineer at least 5 Working Days prior to pouring the concrete. The as-built drawing shall show the conduit run, conduit size, and conduit Material type in red and shall be dimensioned to the nearest 1 inch.

Conduit cable runs shall be parallel to building lines and grouped together where possible.

Conduit runs parallel to curbs shall be placed adjacent to back of curb unless detailed otherwise on the Drawings.

Changes of conduit direction shall be made with manufactured or fabricated elbows of radius not less than that noted in the NEC.

Conduit installed totally within the metering and disconnect enclosure shall be rigid metal and may be without PVC coating.

It shall be the option of the Contractor to use larger size conduit when approved by the Engineer. Where larger size conduit is used, it shall be for the entire length of the run from outlet to outlet.

Conduit terminating in enclosures (poles, cabinets, pedestals, etc.) shall extend vertically above the foundation a minimum of 1 inch, unless indicated otherwise on the Drawings. Exceptions to the 1 inch minimum are indicated on Standard Plan nos. 500a, 521, 524, 541a and 550. Reducing couplings will not be permitted. Conduit shall not change size between handholes, or conduit access point.

Conduit entering through the bottom of a handhole shall be located near the end walls to leave the major portion of the box clear. Conduit shall enter from the direction of the run, terminating 6 to 8 inches below the handhole lid and near the box wall.

All conduit shall be thoroughly cleaned and a proper size mandrel pulled through it prior to installing wires or pull cord. Mandreling shall be done in the presence of the Engineer.

Existing conduit to be incorporated into a new system shall be cleaned with a mandrel and a cylindrical wire brush and blown out with compressed air and a pull cord installed extending at least 3 feet beyond the conduit at each end.

Conduit repairs: When small portions of damaged conduit repairs are necessary, repairs are permitted by using PVC in its place. The PVC shall be coupled to the local conduit by means of beveled edge couplings slipped into place and then sealed with PVC cement. On repairs to steel conduit using PVC, a bonding #6 AWG jumper shall be installed connecting the metal sections together with bonding clamps approved by the Engineer.

Marker stakes or tacks shall be set flush with the ground to locate the ends of stubbed out conduits which may be buried so that they may be located in the future. All stubbed out conduits shall be capped.

Conduit entrances into metal junction boxes (Except NEMA 1) shall be drilled and tapped a minimum of 3 full threads for the size conduit used. Bosses shall be provided where the wall thickness is not sufficient for the minimum number of threads.

Entry to electrical vaults or other Structures shall be made such that the physical integrity of the vault or structure is not impaired. Any hole for entry to vaults or Structures shall be core drilled of a diameter no greater than 1-1/2 times the diameter of the conduit entering the vault. See Section 1-05.2(2) for Electrical Safety Observer requirements.

Annular spaces around conduit, ground wire, ducts, at wall penetrations of vault or other structural walls shall be filled with non-shrink cement sand grout (see Section 9-04.3(2)). Threaded inserts shall be coated with an approved rust preventative compound which is soluble in petroleum solvent.

Conduit entering through the bottom of a handhole shall enter near the end walls so as to leave the major portion of the handhole clear. Conduit shall enter from the direction of the run, terminating 6 to 8 inches below the handhole lid and near the box wall.

At locations designated by the Engineer, fittings shall be installed to provide a conduit channel that permits freedom for installing the electrical control wires. When conduit fittings are indicated on the Drawings, or where their installation is required by the Engineer, the Contractor shall also furnish all necessary covers and gaskets. Expansion/deflection fittings per Standard Plans shall be installed at all structure expansion joints.

Conduits shall be attached to walls and other surfaces (except poles) using approved one hole malleable iron pipe clamps and clamp backs.

Rigid steel conduit may be jacked or bored when approved by the Engineer.

New conduit that does not have wire installed (vacant) shall have a pull cord installed extending at least 3 feet beyond the conduit at each end.

Conduit entrances into metal junction boxes shall be drilled and tapped a minimum of 5 full threads for the size conduit used. Bosses shall be provided where the wall thickness is not sufficient for the minimum number of threads.

8-33.3(2)B RIGID STEEL CONDUIT AND PVC-COATED RIGID STEEL CONDUIT

When rigid steel conduit is cut, the ends shall be made square and true with conventional pipe cutting Equipment. Conduit shall be threaded with a standard conduit cutting die. Burrs and sharp corners at the end of each conduit shall be removed with a tapered reamer. Threads shall be cleaned of all metal, lubricants, red lead, and any other Material which prevents joining with threaded counterparts. Conduit threads shall be coated with a conduit thread compound designed to ease assembly and disassembly, and to improve electrical conductivity. The compound shall be Appleton Company Type TLC-3 or approved equal. Conduit shall be joined by the use of rigid steel conduit couplings. Running threads will not be permitted for coupling conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used. Conduit shall be tightened securely to prevent the entrance of moisture, concrete or other foreign Material and to provide a good electrical connection throughout the entire length of the conduit run. The method of tightening shall not damage the conduit or coupling. Where the galvanizing on the conduit or the coupling has been damaged, it shall be thoroughly painted with galvanizing repair paint Federal Spec. MIL-P-21035 per the manufacturer's recommendations. An Alternate repair method shall consist of applying a heated zinc alloy solder coating to a minimum thickness of 2 mils in accordance with ASTM A 780.

Bushings shall be of the insulated throat type. The entire conduit system shall be properly bonded and grounded in accordance with N.E.C.

Installation of the PVC-coated system shall be made in conformance with the following:

1. **Coupling and Joining:** All conduit connections shall be made mechanically tight with strap wrenches to assure rigidity and maximum electrical conductivity. Over-tightening that results in gouging of the PVC coating will not be permitted. After each connection is completed, any gouges, cuts or abrasions shall be repaired. Solvent weld the sleeves to the conduit at each connection by applying touch-up compound to the PVC coating before screwing on the sleeve. Cutting off plastic sleeves shall be cause for rejection of that length of conduit.
2. **Cutting:** The conduit shall be tightened securely in a vise or chuck. The cut shall be made with a roll cutter or hack saw. When using either a jaw vise or a chain vise, the use of vise adapters will be required. If vise adapters are unavailable, a jaw vise shall be used and the portion of the coated conduit to be gripped in the vise shall be wrapped with emery cloth with the coarse side toward the conduit. The use of a chain vise without adapters will not be permitted.
3. **Threading:** When using a hand threader, a tool with an adjustable guide shall be used. If the threader to be used does not have an adjustable guide, ream the stationary guide 0.10 inch to accommodate the plastic coating. Whittling of the PVC coating will not be permitted. After threading, apply touch-up compound to indentations made by the vise. Raw field cut threads shall be protected by the methods set forth above. For machine threading, the use of a threader designed for coated conduit shall be used.
4. **Bending:** PVC-coated conduit may be bent with conventional bending Equipment; however, the internal walls of the shoes shall be machined out approximately 0.050 inch. Bending shall be accomplished by segmented bending rather than a one-shot bend. For sharp bends, saddles, or offsets, a PVC-coated hickey shall be required. Any cuts, gouges, or abrasions shall be coated with touch-up compound. Coating the exterior of the conduit, prior to bending, with a slippery substance, such as wire-pulling compound, will be permitted.
5. **Touch-up:** During the installation of the coated conduit, the Contractor shall assure that no metal is left exposed or uncoated. Metal exposed as the result of field cuts shall be coated with touch-up compound. If an uncoated accessory must be used, it shall also be coated.
6. One hole malleable iron pipe strap, pipe spacers (clamp backs), and mounting brackets shall be PVC coated.

8-33.3(2)C PVC CONDUIT

PVC conduit shall be assembled with solvent welded joints in accordance with the manufacturer's written instructions. Bends and fittings shall be factory-produced.

8-33.3(3) CONDUIT RISERS

Conduit less than 2 inches in diameter mounted on wood poles shall be mounted by use of 2-hole malleable conduit clamps spaced per N.E.C. A minimum of 2 clamps shall be used per length of conduit.

Conduit sized 2 inches and larger, or more than 1 conduit installed on wood poles, shall be installed using stand-off type brackets. Stand-off brackets shall be installed per N.E.C. with a 10 foot maximum spacing. Attachment shall be near the top of each 10 feet length of conduit.

All conduit risers shall be grounded with a ground clamp installed 8 feet above finished grade. Where conduit risers are connected to a ground rod, a ground rod handhole well shall be provided.

The conduit shall be wrapped with corrosion protection tape conforming to SCL Material Standard 7367.3, 8 inches above and below finished grade.

Conduit risers shall be the size indicated on the Drawings. The 90 degree bend and conduit up the pole to 10 feet above the surface shall be rigid steel. The riser above the 10-foot level shall be PVC, Schedule 80. The riser shall be equipped with a PVC weatherhead and shall be grounded as indicated on Standard Plans.

8-33.3(4) HANDHOLES

Handholes shall be installed per Standard Plans. The frame (ring) and lid shall be grounded with an approved grounding clamp(s) to the ground rod at the locations shown on the Drawings. Unless dimensioned, handholes are located schematically, and shall always be located outside the pedestrian travel way. *The Contractor shall provide the Engineer a minimum 1 Working Day advance notice regarding the exact handhole location.*

When required by the Drawings, handhole extensions shall be provided and installed.

Unused conduit openings in handholes shall be capped to afford protection against debris from entering the conduits.

See Section 8-31.3(1)B for handhole access requirements.

8-33.3(5) JACKING OR BORING

Rigid steel conduit may be jacked or bored when approved by the Engineer. Rigid non-metallic type conduit may be installed under existing pavement if a hole larger than the conduit is predrilled and the conduit installed by hand.

8-33.4 MEASUREMENT

Bid items of Work completed pursuant to the Contract will be measured as provided in Section 1-09.1, Measurement of Quantities, unless otherwise provided for by individual measurement paragraphs *herein* this Section.

Measurement for "Conduit, (Material), (Size)" will be by the linear foot measured on the ground along the conduit to the center line of pole, to the 90 degree bend of a conduit riser, to Equipment, or to the inside face of a handhole or of a vault.

Measurement for "Conduit Riser, (Size)" will be by each from and including the weatherhead to and including the 90 degree rigid steel bend underground.

No separate measurement will be made for jacked or augered conduit. No measurement will be made for removal or restoration of surface improvements where the conduit is jacked or augered, but such measurement will be made at jacking pits and access holes in accordance with Section 2-02.4.

Measurement for pavement restoration will be in accordance with Sections 5-04.4 and 5-05.4 as applicable.

8-33.5 PAYMENT

Compensation for the cost necessary to complete the work described in Section 8-33 will be made at the Bid item prices Bid only for the Bid items listed or referenced as follows:

1. **"Conduit, (Material), (Size)"**, per linear foot.

The Bid item price for "Conduit, (Material), (Size)" shall include all costs for the work required to furnish and install the conduit complete including all bends, fittings, condulets and hardware.

2. **"Trenching, Conduit"**, per linear foot.

The Bid item price for "Trenching, Conduit" shall include all costs for the work required to excavate, backfill with suitable Material, and compact the trench section for both conduit and conduit riser trenching. Payment for replacement of native material determined unsuitable by the Engineer will be in accordance with Section 1-09.4. All costs for replacement of suitable native Material which becomes unsuitable due to Contractor operations shall be at the Contractor's sole expense.

3. **"Conduit Riser, (Size)"**, per each.

The Bid item price for "Conduit Riser, (Size)" shall include all costs for the work required to furnish and install the complete riser, including all conduit, fittings, clamps and hardware from and including the weatherhead to and including the 90 degree rigid steel bend underground.

4. **"Handhole (Type)"**, per each.

The Bid item price for "Handhole (Type)" shall include all costs for the work required to furnish and install the handhole complete including excavation, backfill and compaction, groundrod, and handhole extensions when required.

5. **Other payment information.**

Payment for jacked or augered conduit will be made at the Bid item price for "Trenching, Conduit".

All costs for ground rod wells shall be included in the Bid item prices of the applicable Bid items.

See Section 1-05.2(2) regarding payment for Electrical Safety Observer.